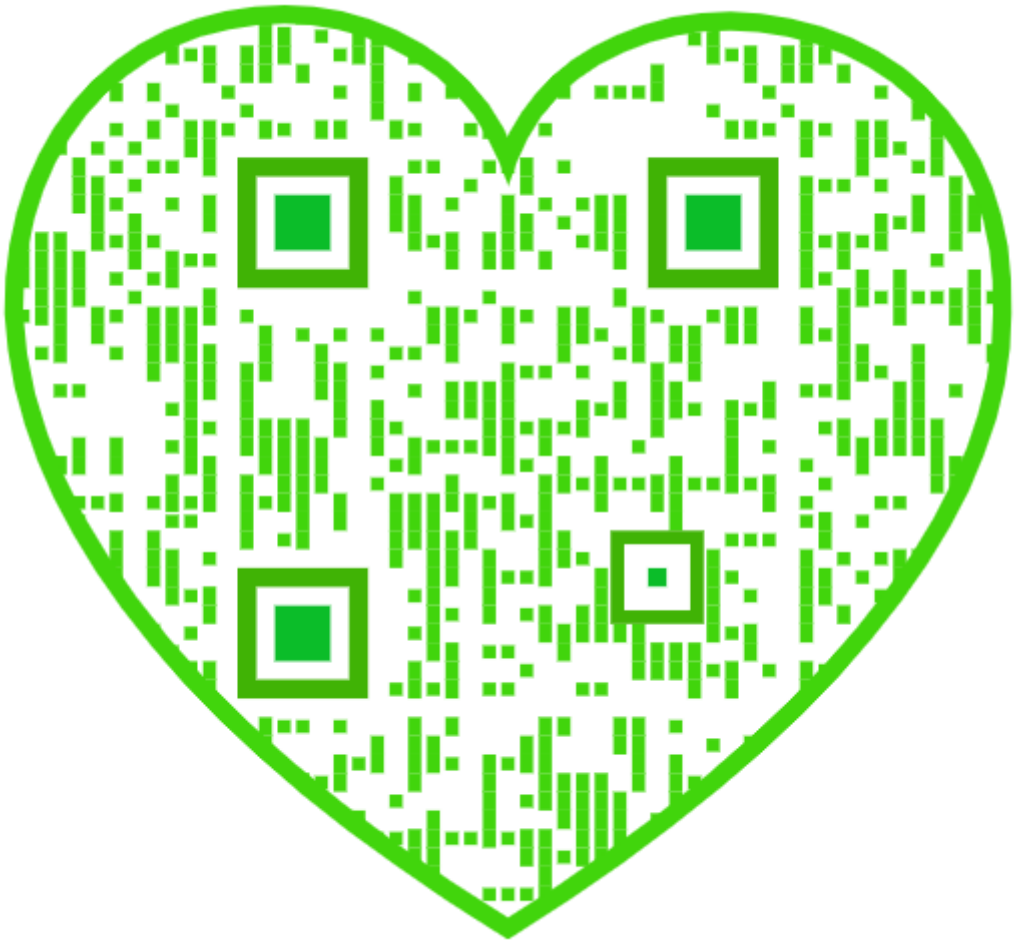

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A TREATISE

ON

SURGICAL THERAPEUTICS

OF

DOMESTIC ANIMALS

BY

P. J. CADIOT, PROF., AND J. ALMY, ADJUNCT

IN THE VETERINARY SCHOOL OF ALFORT

TRANSLATED BY

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PREFACE

WHEN the *Traité de Thérapeutique Générale Vétérinaire* of Professor Cadiot was issued, it appeared to me that the English-reading practitioner, as well as the students of our veterinary colleges, would be benefited by its perusal, and for that purpose I obtained from the author permission to translate it.

It is thought by the translator that in undertaking to present the work in its English form, he should add a contribution which he hopes will prove valuable, especially to the branch of General Surgery, which is perhaps still deficient in English veterinary literature; but, as no reference to American work is made in the original text, the translator will take the liberty to add notes, whenever in his estimation due credit can be inserted, in relation to what contribution he can gather from American works.

It is possible, however, that in adding these notes some omission may occur; in which case it is hoped that the indulgence of the reader will not be refused to the author, who will have then sinned without intention.

My principal desire is to have the English-speaking profession benefited, and give its members an opportunity to be well acquainted with all the progress made in Veterinary Surgery up to this day.

A. LIAUTARD.

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FIRST PART

TREATISE

ON

VETERINARY SURGICAL THERAPEUTICS

FIRST PART.

GENERAL SURGERY.

I.

MEANS FOR THE RESTRAINT OF ANIMALS.

Since all tissues, with the exception of those of epidermic or epithelial nature, are provided with sensitive nerves, almost all operations are painful, and give rise on the part of the animal to reactions which are dangerous for the operator, his assistants, or the patient itself. Under the influence of the pain produced by the instrument no animal will remain quiet. It will resist and try to defend itself, so that the surgeon who wishes to act with safety must take precautions against injury. The horse with his feet or teeth, the steer with his horns or his legs, the dog and the pig with their teeth, the cat with its claws and canines, may inflict dangerous wounds.

A number of veterinarians have paid with their life for their negligence and lack of precaution in providing means for the control of large animals. Generally means of restraint must be employed. Yet, with kindness, caresses, and patience, one may succeed in controlling an animal, which threats and pain would only exasperate and possibly render more dangerous. Rough handling and infliction of great pain have often caused serious accidents. It is on account of such treatment that a great many horses hurt, disable, or kill themselves, and that too many men become victims of their own unskilfulness and their own brutality. (Bourgelat.)

It is preferable to fasten the animal standing, even if the restraint of a recumbent position allows an easier surgical operation. Such a

position also suggests the possibility of strong reactions, which may be the cause of fractures of the vertebral column or of a bone of the extremities, of paralysis or various other accidents of a serious nature. The victims of a forced recumbent position are not now taken into account.

Only slightly painful operations, or those required for internal diseases, should be performed in the stable. Not only is this place, ordinarily, badly lighted, but there is danger of the operators being squeezed against the wall or the partitions of the stall. It is better to select, close by, a convenient place (grass or soft ground), which should be covered with straw. On pavement, or on a hard and slippery surface, the horse is liable to slip and injure its knees.

As it is important to see well what one is doing, operations should be performed by daylight. Bothersome, curious, and useless witnesses would better be kept away. One should take a good position for avoiding injuries from the patient. At night lamps are used to light the place used for the operation.

I.

SECURING OF SOLIPEDS.

Restraint in the Standing Position.

When a horse is to be held in hand it should have on a bridle or a halter. If the latter is used, better control is obtained if a rope passed in his mouth rests upon the bars. In some cases the cavesson is useful. At times, for operations performed in certain regions, the animal is tied to a ring or a post with an ordinary halter or one still stronger. The rope of this should never be left in the mouth or over the animal's nose, as the horse, pulling backwards, may injure its tongue or fracture its jaw. The bit or the bridle should not be used, since they are likely to give rise to the same accidents.

After the animal has been thus prepared it may be possible, by kind treatment, as well as by these means of restraint, to obtain a sufficient submission on the part of the animal to perform a comparatively painless operation. But many horses are so restless that violent measures must be resorted to. Often applying the old aphorism, "that of two simultaneous pains, not in the same spot, the more severe renders the other less apparent," the "*twitch*" is used. Is it for a simple incision, a free counter-opening, the lancing of an abscess, the exploration of a fistula, or the removal of a small neoplasm, the "twitch" is applied to the upper lip, and the pain resulting from its twistings is such that the animal does not react under that produced by the instrument. Applied to the ear, or to the lower lip, this revulsive does not act so well. The assistant who holds the

"twitch" places himself in front of the patient, a little towards the side, to avoid kicks from the fore legs. A "twitch" can be made readily with a piece of rope and a small stick. "*Barnacles*" are used for the same purpose. Two rods of iron or of wood, fastened together at one end with a hinge or a rope, are placed on the upper lip, embracing it; then they are brought together and secured by a ring or a cord at the other end. The "*Polish barnacle*," also called "*German bit*," is advised when the application of the twitch is difficult, because the horse resists, kicks, or bites. It is made of a cord some three or four meters long, having at one end a small loop or a ring. A large loop is made in passing the cord into the mouth, over the poll, and again through the ring. A more or less vigorous pull on the cord will proportionately distend the commissure of the lips, compress the cheeks, and produce much pain. The cord can also be made tight by twisting it with a piece of stick. Some authors advise inserting the finger or a bullet of lead in the ear. Gohier relates the case of a celebrated stallion which could not be shod without having in his ears bullets held together with a string. Many dangerous animals become quiet when they are temporarily blinded with a "cap" made of cloth or leather, or by simply having the head covered with an apron. To the horse that bites or defends himself with his teeth the "muzzle" is applied. This may be replaced by a cord round the lower part of the head, passing over the nose, and twisting round the neck of the inferior maxillary bone; this is an excellent device. The "*cradle*" or "*side bar*" is advantageous in preventing an animal from biting the lateral parts of the trunk, the chest, or the fore legs.

In some cases, when one operates on the fore legs, the anterior regions of the trunk, or the head, it is prudent to have this last held downwards by one or two assistants. A cord or a leather strap fastened to a halter is sometimes used, passing it between the fore legs, through a ring of the surcingle and then back again to the ring of the halter, where it is secured. The head should be held upwards, if one operates on the hind quarters of the animal.

Raising one leg of an animal reduces his base of sustentation and renders it difficult for him to strike or kick. To raise a front foot, one takes hold of the canon, flexes it on the forearm, and keeps it in that position with both hands round the coronet—or holds it simply by grasping the toe with one hand, the thumb resting on the sole or the arch of the shoe and the fingers on the wall of the foot. Ordinarily, a strong assistant can easily do this, especially if the twitch is used. But if the horse resists, moves constantly, or if the operation lasts some time, the *strap* or the *plate-longe* is employed. The use of the former is common to all blacksmith shops; its advantages are well known. With the plate-longe, the foot may be

secured in various ways: 1st, fixed round the pasterns, it is carried up to the withers, round the thorax, back under the canon of the foot, raised, and pulled on horizontally; 2d, fixed on the coronet and the canon flexed on the forearm, it is rolled round both of these and its extremity held by an assistant.

Instead of the plate-longe, one may use the *foot-raiser*. It is made of a wide strap some 0.60 centimeters long, having a buckle at one of its ends and a number of holes at the other, thus making firm the knee flexed on the forearm and rendering them immovable, so that the animal cannot strike with his foreleg. A long leather strap or a single rope may replace the foot-raiser. The one invented by Trasbot consists of a leather strap about 1 meter 20 centimeters long, pierced with holes, having at one of its ends a flat ring and on one side, at about 25 centimeters from the ring, a buckle.

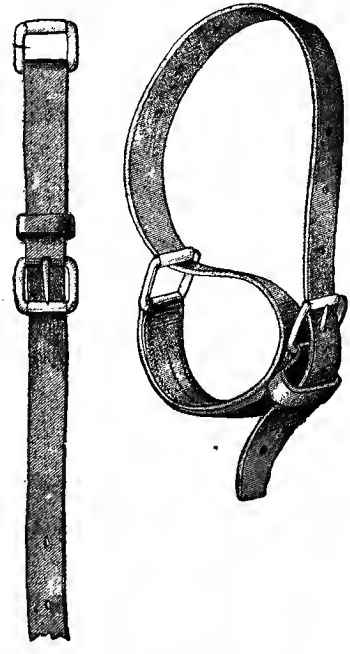


Fig. 1—Foot raiser (Trasbot.)

The strap running through the ring forms a loop fixed on the coronet; then is wound around the forearm, passing from the inner to the outer surface, where it is secured by the buckle (fig. 1). With the foot-raiser, horses soon get tired of struggling, and can be easily approached.

To raise a hind leg, more strength and skill are necessary. The assistant, placed on the side of the leg to be raised, passes his hand from the back forwards on the inner face of the canon; by a gradual traction upon the leg he raises it from the floor, then resting it on his thigh holds it with both his hands around the coronet. To hold the foot, sometimes a rope tied to the tail and passed under the flexed coronet is used in preference. For the anterior legs, a strap or the plate-longe is used. The former, placed around the neck, secured by a straight knot, and carried backwards along the spine, is twisted around the base of the tail, then round the coronet, when by a backwards traction the leg is raised. It is preferable, in using this last mode (the plate-longe), to place a hobble round the coronet, and to pass the rope through the ring of the hobble.

It is also with the assistance of the plate-longe that one of the hind legs may be carried forward. Fixed to the canon or to the coronet

by a slip knot, it is carried forward between the forearms, passe round the opposite shoulder, brought to the withers along the rit to the elbow, where, made to cross itself from within outwards, is given to an assistant to hold. A sufficient pull on the rope wi raise the leg from the ground and carry it forward (fig. 2). Th patient is thus prevented from kicking with either of his legs.

Surrounding the base of the neck with a loop of the plate-long secured with a straight knot, in order to avoid pressure upon th

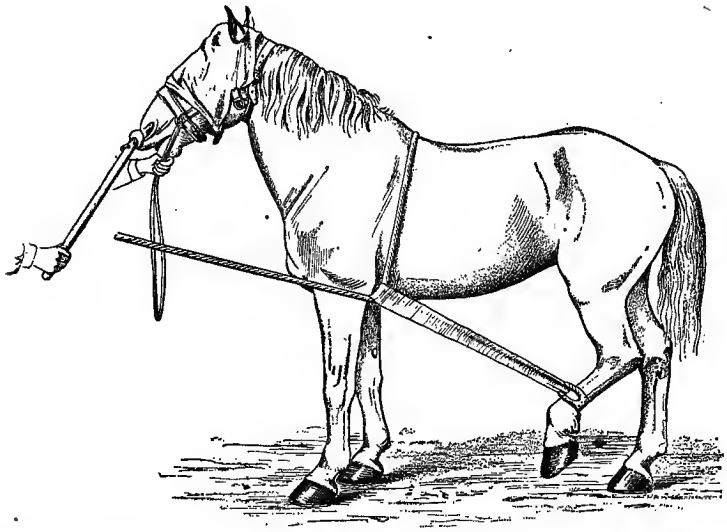


Fig. 2.—Hind limb lifted and carried forward by means of the kicking-strap. (From a photograph.)

trachea, then carrying its free end between the hind canons passing it round the coronet of the leg to be raised, and bringing i back to the elbow to cross, is not a thing to be recommended: the animal struggles, the rope may bruise or chafe the skin of th coronet, or even the subcutaneous tissues.

To immobilize the two hind legs, two hobbles are used, one single the other, the *king* hobble; these are placed round the hind coro nets, the ring turned forward and the chain or rope of the main hob ble passed through the ring of the other. It is stayed with a knot o in the usual way, and then its free end is carried forwards betwee the fore legs, around one or the other of the shoulders, to the back to the sides of the chest, and to the elbow, where, crossing itself fron within outwards, it is entrusted to an assistant (fig. 3).

There are other devices: Put upon the horse a surcingle having two rings on its outer surface, one on each side of the vertebral col umn, take two strong ropes or plate-longes, fix them at one en round the coronets, pass them forward through each corresponding

ring of the surcingle, and tie them at the head on the nose band of the halter or of the cavesson (Keller). Put hobbles on the hind coronets, pass each of the ropes round the superior part of the corresponding forearm and tie them together over the withers.

The "*Le Goff hobble*" allows the immobilizing of either fore or hind quarter. In the former case, the apparatus, which has the shape of a Y, is fixed to the two fore and one of the hind coronets. If one operates on the hind quarter, the two posterior coronets and one anterior are secured in the slip knots of the apparatus.

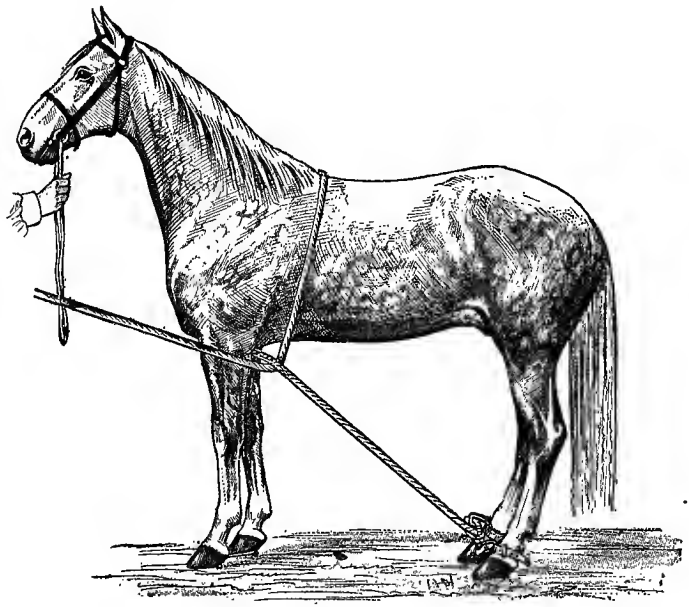


Fig. 3.—Contention of the hind limbs.

To limit the movements of the two legs on the same side of an animal, both can be secured with two of the branches of the Le Goff hobble, or with a rope or strap having a slip knot at each end. (Chelchowsky.)

The *Hippo-lasso or lasso-breaker of Raabe and Lunel*, a kind of strait-jacket for animals, is composed of a Dutch collar and a breeching which can be brought close together by two lateral straps, so as to diminish, at will, the base of sustentation of the animal (fig. 4). In pulling the straps tight, the possibility of the displacement of the extremities is limited, and even prevented, if the tightening is sufficient to threaten the animal with a fall. The advantages of this apparatus are already well known, and nothing can be added to what has already been said by Lecoq, Rey, Bouley, and many others. It can be replaced by an ordinary plate-longe or two ropes

or straps. The plate-longe is passed around the animal, at th height of the superior part of the forearms and above the hocks, an secured, the two ropes or straps thrown over the withers, and th loins are tightened to it on both sides. (Butel.)

The *electric bit*, invented by de Place, to render the shoeing o restive horses easier, could also be utilized to assist in the perform ance of other operations in the standing position.

It is composed of a box containing a chloride of ammonium pile a graduated interrupting inductor bobbin, conductors to carry communication between the bobbin and the mouth of the horse, an a special bit.

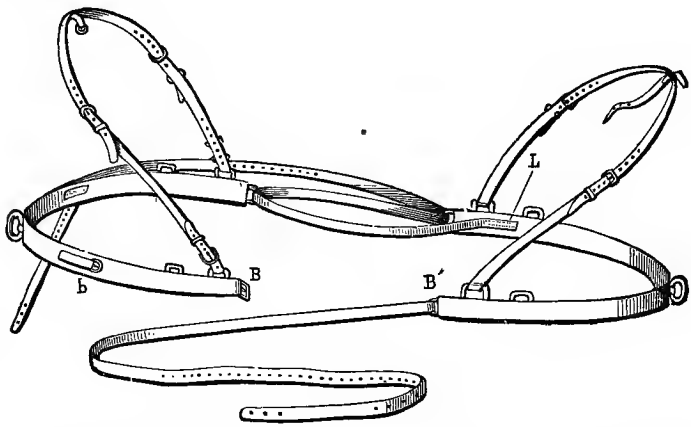


Fig. 4.—Hippo-strap.—B, B', b, buckles; L, thong, its end being attached to the breeching.

It is a volta-faradic apparatus giving inductive currents (fig. 5). "The pile is connected by a commutator D to the thread of the bobbin, whose induction is carried to the bit through the medium of the two collectors of currents A and B. The bobbin thus gives currents of induction which are repeated as many times a minute as the interruptor I oscillates in the same time. A special apparatus, consisting of a commutator button E and a third collector of currents C, allows the operator to vary the number of shocks, the intensity o which in both cases is regulated by means of an induction coi with a graduated tube F, which gives a stronger current the further it is removed from the bobbin. All that is required to put the instrument in action is to move the commutator D upon its vertical axis in such a manner that its metallic end will rest on the button H. If the interruptor or current breaker does not at once do its work, it can be made to vibrate gently with the finger; and its motions will then continue.

"To use this apparatus, a cavesson is placed on the horse's head,

held by a strong man, the bit put into the animal's mouth, and conductors, which at their other end are secured in the holes of the collectors A and B, attached to the extremities. The commutator D is turned on, and the operator, holding the instrument in his left arm, watches the motions of the animal, which may give him a notion of what to expect. The first shock is given by pressing the button E. The animal rears, backs, while the assistant, following it in its movements, firmly but without jerks pulls on the cavesson. At the slightest show of resistance he gives a second or a third shock as the case may require."

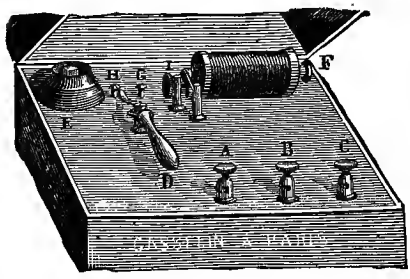


Fig. 5.—Place's volta-faradic apparatus

It often happens that after this the animal remains quiet. If it resists, the conductors are attached to B and C, and the graduating tube drawn away to a greater or less distance. The continuous current can be stopped or allowed to go on by movements of the commutator D.

While most high bred animals will be subdued by the first shock, even when it is very light, some of common, low breed, and of unusual viciousness, will stand all the strength of the current and become submissive only after several shocks.

We shall not here describe the ordinary *post stocks*, whose first types go back to the days of Greek hippiatres. They are found more or less everywhere. They immobilize the patients well, prevent lateral movements, falls on the ground, and injuries to assistants and operators. Though little used in Germany they find great favor in France. In the absence of stocks, Lucet recommends a contrivance very practical in country districts—a two wheeled truck, firmly blocked to prevent its moving, and with the shafts well secured at a proper height. Into this the horse is introduced between the shafts head first and securely tied, while a bar placed transversely behind his haunches may be used to fix one of his legs, as is done in the post stocks.

Vinsot has invented an advantageous *moving stock*, which permits of an operation being performed in the standing or the recumbent position (fig. 6). To place the horse in those stocks, open by removing the horizontal bar (b), which is returned to its place when the animal is in. The head is fixed to the front upright posts ; under the chest an apron is stretched, carrying two prolongations, which, passed between the posterior legs, support the hind quarters. The

feet are fixed with hobbles to a metallic chain (c) resting on the ground, in the axis of the apparatus, and stretched by a crank. The anterior legs may be attached to the side bars, the posterior to the

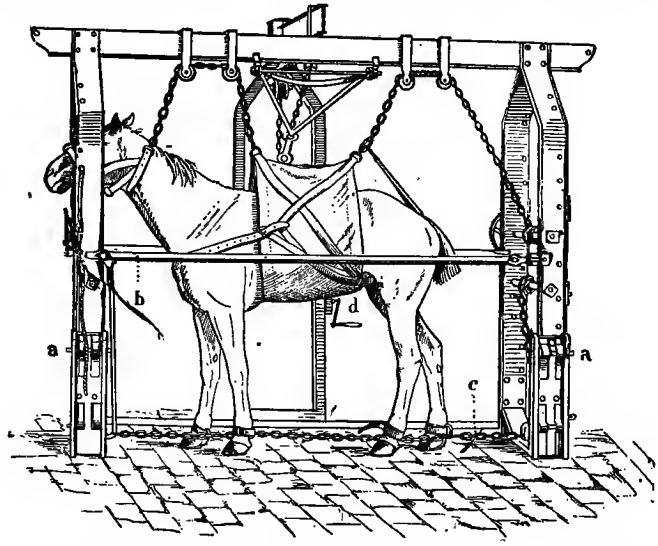


Fig. 6.—Vinsot's apparatus.

posterior transverse bar by the means of the crank. For castration standing, the left hind leg is carried backwards, the operator bending down under the left flank. Setons, opening of abscesses, dental operations, firing on small surfaces, thinning of the horn, several operations upon the foot, and their dressings are easily performed with this apparatus. (See *Recueil de Médecine Vétérinaire*, 1892, page 72.)

De St. Maurine, an army veterinarian, is the inventor of a wooden moving stock, of easy construction, and less costly, with which an animal can be secured standing, or lying down, as in the Daviau bed.

There are many other means of restraint—the list is very long. The simplest, however, are the best. The animal is brought to the place where it is to be operated upon, its head is covered with a cap; a twitch is used to distract its attention; a fore or a hind leg is raised; if all this fails, the animal is to be secured in the recumbent position.

Restraint While Lying Down.

CASTING WITH HOBBLES.

When the operation is to last some time, is painful, or demands an immobility as complete as possible, the animal is thrown down.

In the country, this is done ordinarily upon a straw bed suffi-

ciently thick to prevent fractures from falling. Frequently it is done in a field close to the stable, in a yard, under a shed, where is made a straw bed of variable thickness, according to the hardness of the ground upon which the animal is to fall.

Restraint upon a straw bed is objectionable, since it makes perfect asepsis of the wounds difficult; on that account special mattresses are recommended. That of Merle, which we employ, is formed of four sacks of impermeable cloths, filled with straw and measuring three meters in length by sixty centimeters in width and hooked together with covered hooks. When the animal is to be turned over, the sacks upon which the legs are resting are unhooked and placed on the other side of the mattress where the animal will rest. The disinfection is easy, the cost of the apparatus trifling. A simple awning stretched over the straw bed has the same advantages.

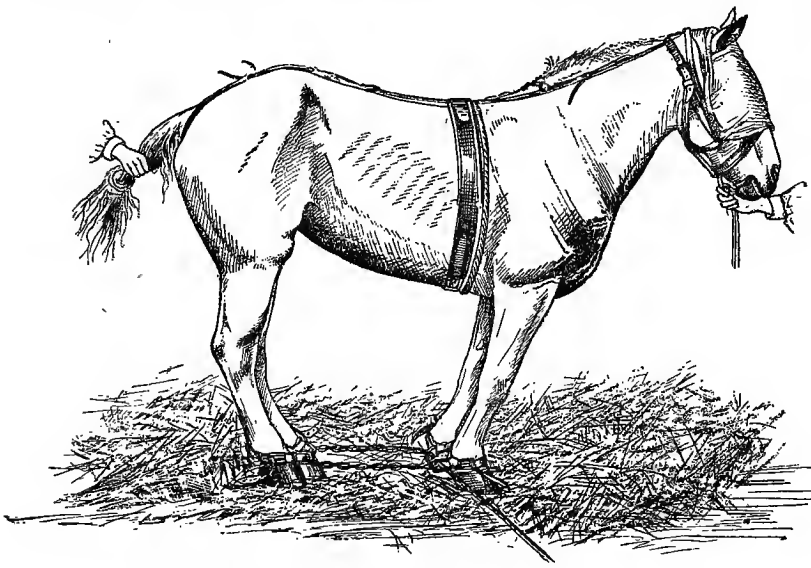


Fig. 7.—Throwing of the horse. Common process. (From a photograph.)

The horse, with an empty stomach, the head held with a bridle or a strong halter and covered with a cap, is brought near the bed and held by an assistant. The hobbles, with buckles converging, are placed on the four legs—the main hobble fixed on the anterior leg opposite the one on which the animal will lie. The chain of the hobble is then passed through the ring of the hind leg of the same side, then through that of the two others and brought back to the king hobble. A plate-longe is passed round the body, back of the withers. Two assistants hold its extremities. Another grasps the tail to pull on it in the same direction as those on the rope of the body (fig. 7). In order that the animal may not fall too heavily,

the legs are brought close together by backing, or by carrying the hind legs forward. The chain is put on the stretch by the steady pull of three or four assistants. At a given signal, a common action takes place, the legs are brought together, and the animal, feeling its threatened fall, bends its legs, while the traction on the trunk, the tail, and the head bears down the mass of the body. When the horse is cast the head should immediately be stretched out lying down.

The chain of the hobbles is secured by a fastener of any kind, or a padlock passed through one of the links.

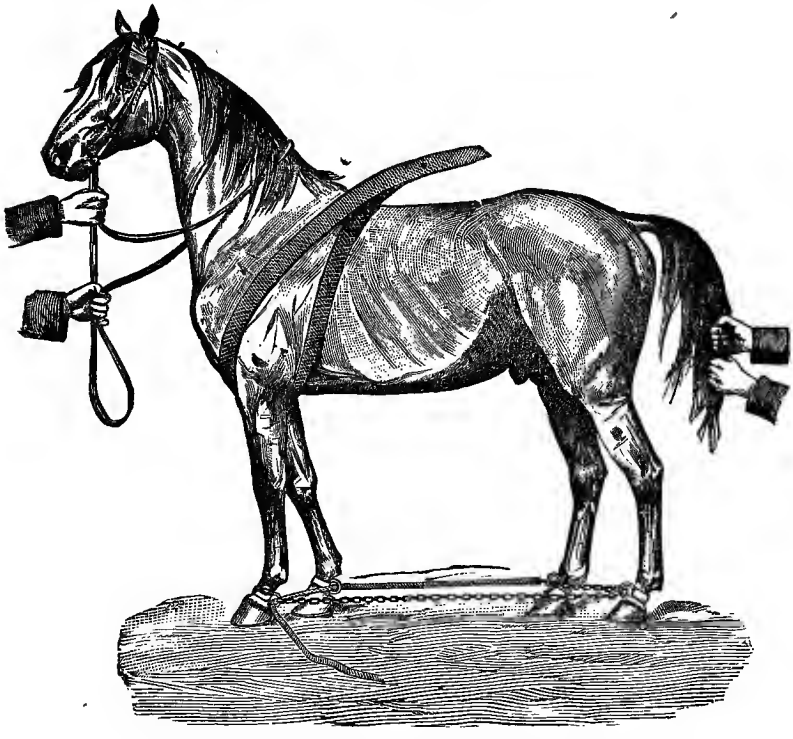


Fig. 8.—Throwing process in use at the Berlin College. (Moller.)

The apparatus of Bernadot and Butel (fig. 7), has proved advantageous in keeping the head and neck extended, and preventing the arching of the vertebral column and violent struggling.

The process used at the surgical clinic of Berlin differs from the preceding in the manner the plate-longe is placed; this has in its middle a wide loop passed under the shoulder of the leg opposite to the side on which the horse is to be thrown (fig. 8), the straw bed being covered besides with a wide leather mattress.

When one has to deal with an irritable or very strong animal which has been cast for operations on previous occasions, he must

act quickly. As soon as one hobble is put in position, those animals will become nervous, kick, and be more or less dangerous to approach. It is for them that Trasbot recommends the use of the foot-raiser, which is placed on the fore leg opposite to the side upon which the animal will fall. When once this is in place, the animal is made to go round the straw bed once or twice. He resists, rears, struggles, but soon submits himself to the placing of the hobbles. The chain of the king hobble, which has been placed on the hind leg of the side of the secured fore foot, is then run through the ring of the hobble of the other hind foot, then round that of the fore leg, which is on the ground, and brought back to the king hobble

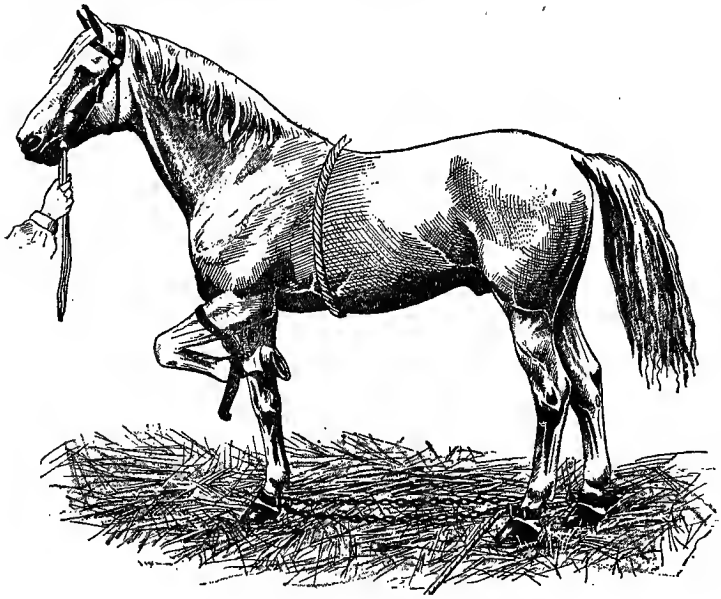


Fig. 9.—Throwing with the foot-lift.

(fig. 9). The horse is cast with three hobbles, the foot held by the foot-raiser remaining free.

Thus thrown, the horse reacts less, his struggles are less violent, there is less possibility of fractures by muscular contractions.

It is often necessary to change the position of a leg. For operations of the inguinal region, the upper hind leg is carried forward and secured on the corresponding shoulder. A side line fixed to the coronet or the fetlock is carried toward the withers, then under the neck, brought back to the inferior part of the leg from below upwards, and then in the direction of the croup.

To operate with more facility in the inguinal region (hernia, cryptorchidy), the upper hind leg can be carried in excessive abduction as follows: Two side lines fixed on the canon are passed through

rings sealed in the wall, or round solid posts secured to the floor, and are pulled, one in the direction of the withers, the other perpendicularly to the vertebral column.

Fig. 10.—The right fore limb is carried upon the corresponding hind limb. (From a photograph.)

If one fore leg has been displaced and secured on the superficial hind one, the side lines fixed to the canon of the first are carried toward the lower part of the leg, passed over and under it, then for-

Fig. 11.—The right hind limb is carried upon the corresponding fore limb. (From a photograph.)

ward, twisting round the forearm, first under and then over it, the assistants pulling on the side lines when the foot is out of the hobble, as in fig. 10. Then the leg is secured by two figure 8 twists and a circular knot.

If it is a hind leg which is to be carried forward, the side line fixed upon its canon is passed round the lower third of the forearm, over

and under, brought back on the leg and drawn by two assistants toward the croup. Another side line stretched above the knee assists considerably the manipulation. (Fig. 11.)

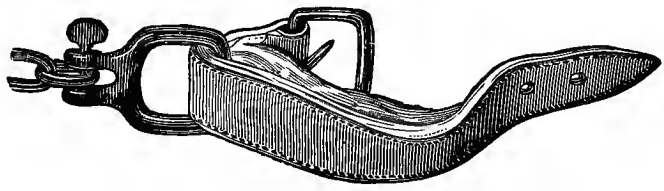


Fig. 12—Bracy-Clark's hobble

With a figure 8 twist above the knee or above the hocks, the fore leg or hind leg being secured, can be carried either forward or backward with a side bar.

To place the animal on his back, the chain, passed into a ring or to pulley above, is pulled upon and held by two or three assistants.

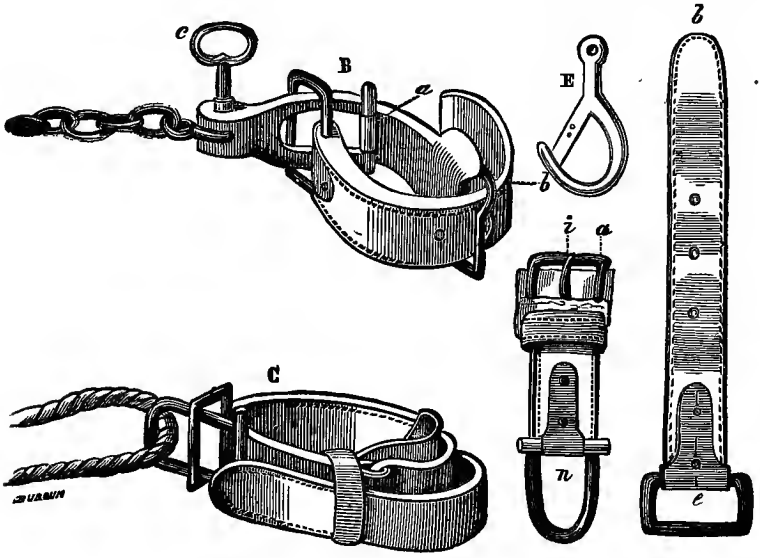


Fig. 13—English hobbles.—A, disconnected hobble; b, e, long strap; i, n, short strap; a, buckle with its tongue.—C, appearance of the hobble when fastened in its place.—B, king hobble; c, key.—E, swivel hook. (Peuch and Tonissant)

The animal can be held in the same position with a bar passed between both fore and hind legs and held up by assistants, who support it perpendicularly to the axis of the body.

To remove the hobbles, the surgeon and one assistant, placed a little beyond the reach of the extremities, unbuckle those of the lower fore and hind legs and then those of the upper. This must be

done simultaneously and without any abrupt motion, which might cause the animal to struggle.

The modification found in the Chedhomme improved hobble facilitates this removal, but wants security. The majority of veterinarians prefer the English hobbles as being superior.

These admit of much easier removal than the French hobbles, which require more unbuckling. The hobbles of Bracy Clark are like the ordinary ones, but the chain of the main hobble is fixed to it by a movable screw, which, once removed, leaves all the hobbles loose. (Fig. 12.) When the animal gets up it has them round each coronet, from which they can be readily taken off. With the more recent English hobbles (fig. 13), the legs become free at once because of the manner in which the hobble is made—viz., of two leather straps of unequal length united into one piece by a buckle at one end, and each carrying at the other end an eye of different shape and size. That of the long strap is somewhat square and made to allow the introduction of the elongated ring of the short strap when the hobble is placed round the leg. The animal is cast in the same way, the chain secured as above described; and when he is to be made free the screw of the main hobble is removed, the chain gets loose, the hobbles drop off themselves or are kicked off by the animal when he attempts to rise. Sometimes he throws them off from his hind legs with much force and not without danger to the lookers on.

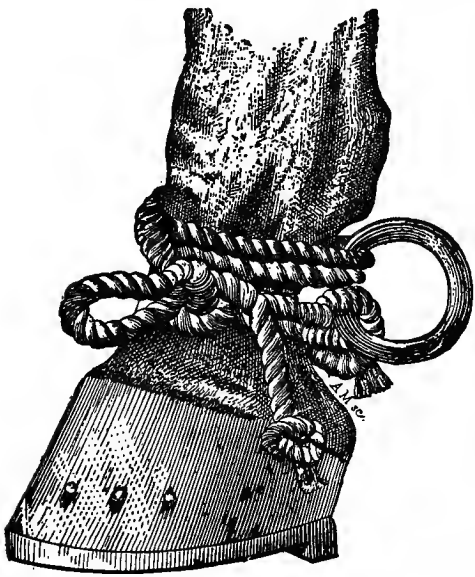


Fig. 14.—Denenbourg's improvised trammel (Peuch and Toussaint.)

Bourquet's hobbles possess the same advantages.

Denenbourg has made hobbles "economical and easy to carry." (Fig. 14.) Take four iron rings, four pieces of cord, and a chain. The rings are fixed with the cords round the coronets of the four legs, turning backwards for the front and forwards for the hind legs, as in figure 14. The animal is thrown and secured as with the ordinary hobbles.

Suykerbuyck has a very simple set of hobbles, which Degive

described as follows: Each hobble (fig. 15, A, B, C) is formed by several cords braided together, or by a single one, as large as a large lead pencil, folded in two. These being twisted, are tied together in a simple round knot. This double cord should measure about 75 centimeters in length. A ring is fastened to the loop formed by the folding of the cords with several twists of a small, stout string. Figs. B and C show how the hobble is to be placed on the leg of the

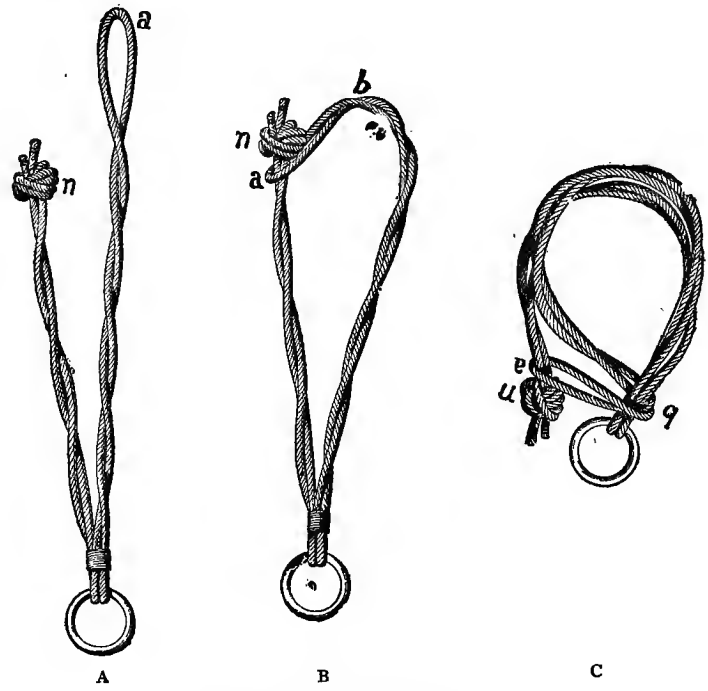


Fig. 15—Suykerbuyck's hobbles. (Degive.)

animal. This can be done in two ways: 1st, the hobble, made as in B, is fixed on the leg by passing the ring through the double loop *b*; 2d, the open hobble, as in A, is put against the inner face of the coronet, the ring turned backward (front leg) or forward (hind leg); then, after passing the cord near the ring so as to form the double loop *b*, the single cord *a* is brought back on the stopper knot *n*. The set is easily removed, the legs being brought together to relax the hobble. One hand is sufficient to make the loop *a* slip over the knot *n*, and thus free the leg which was fastened. The Suykerbuyck hobble forms a kind of slip knot, which can be adapted to all coronets, no matter of what dimensions. It is long enough for a big horse, and can also be applied to a small one, a colt, or a pony.

Improvised hobbles may also be used for small animals. Four pieces of strong cord are fixed on the coronets with a simple knot, leaving sufficient space between them and the skin to run a rope through, which takes the place of the chain.

CASTING WITHOUT HOBBLES.

By the *Rohard process*, a long cord or two side lines tied end to end are necessary. At about two and a half meters from one of the extremities a slip knot and a stopper knot are made so as to make this part of the cord represent a kind of loop. If a horse is to be

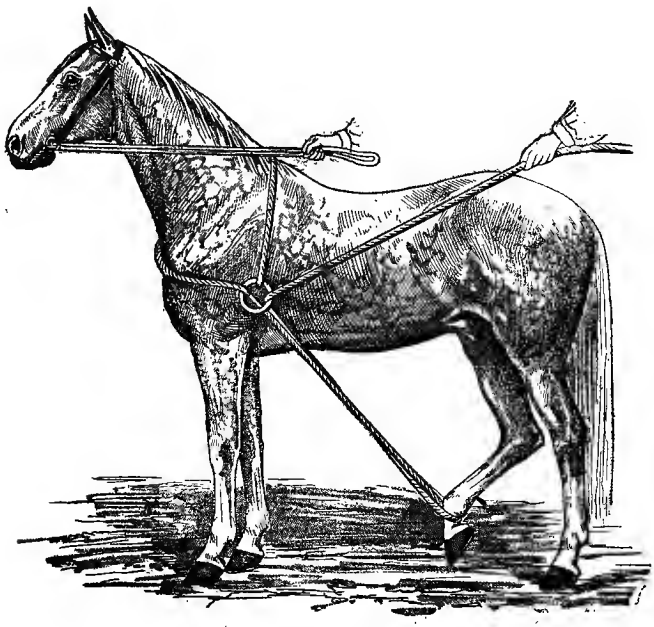


Fig. 16.—Throwing by the Russian process.

thrown on the near side, this loop is passed round the neck at its base, the knots resting on the external face of the forearm ; the free part of the rope is twisted round the forearms to secure the fore legs ; it is, afterward, passed from the outside to the inside inwards round the coronet of the left leg, then carried along the right side of the ribs towards the posterior parts of the withers. The operator places himself on the left side, a little back of the shoulder, holding the loose end of the rope, slowly pulling on it, while he slightly strikes on the lower part of the left hind leg ; this is soon raised from the ground and then carried forward by the traction of the rope. As

soon as the animal tries to defend itself, the assistant at the head and the operator pull together. "The animal slides, so to speak, on the body of the operator," and falls without danger. The two hind legs are secured with the rest of the rope.

The *Russian method* is analogous to that of Rohard. It consists in raising a hind leg and pulling the head and trunk in the direction in which the animal is to fall. If the horse is to be laid on the right side, a stout rope is passed round its neck in a loop which has a ring, where it rests on the left elbow. Another rope, or a long leather strap, secured to the ring, is carried round the near hind leg from within outwards, then back to the ring, and is pulled upon backwards from the opposite side. (Fig. 16.) The operator, standing on the side where the animal is to fall, pulls on the halter or bridle with one hand and on the rope with the other, and with moderate force compels the horse to lie down.

For donkeys and very small horses the following method is very convenient: Take a side line, fix it by one of its ends to a front coronet, fasten it to that of the opposite fore leg. With a second side line fix both hind legs in the same way. Pass the former side line backward between the hind legs, and the other forward between the fore legs. When the assistants at the head and at the tail pull on them the animal falls. Twist the ropes tightly together, have them held by assistants.

With the *Daviau table*, aseptic operations can be performed, and its use is not accompanied with fractures and muscular lacerations so frequent with the other means used for restraint in a recumbent position. It consists of a solid wooden table, to which is fastened as a covering a thick mattress, and which, by a special mechanism, moves from a vertical to a horizontal position. While the table is vertical, the animal, with his head covered with a hood, is brought near it, and immobilized with straps and hobbled (fig. 18), all the cords being secured to wooden pins on the under side of the table. When the horse is secured, the crank of the mechanism is put in motion and the table brought to the horizontal position and the height required for the operation. Generally, with this apparatus, animals react but little. When this apparatus was first made, it was necessary, in turning the animal over, to relieve it from its first position, and then to secure it in the same way on the other side. With the improved table, which is mounted upon wheels and which can be firmly fastened to the ground, the horse can be turned over without changing the horizontal position of the table.

With the *Vinsot apparatus* (fig. 6), the horse can also be turned over without difficulty. He is fixed as for standing operations, with the head secured to one of the upright posts, the sling and the chains

made tight. To the horizontal bar upon which the horse will rest, a double cushion is attached to form a table. By action of the great

Fig. 17.—Throwing with two leading-reins.

crank (d), this apparatus, turning on the axis (a a) as a pivot, situated at some distance from the ground, is gradually brought down. It

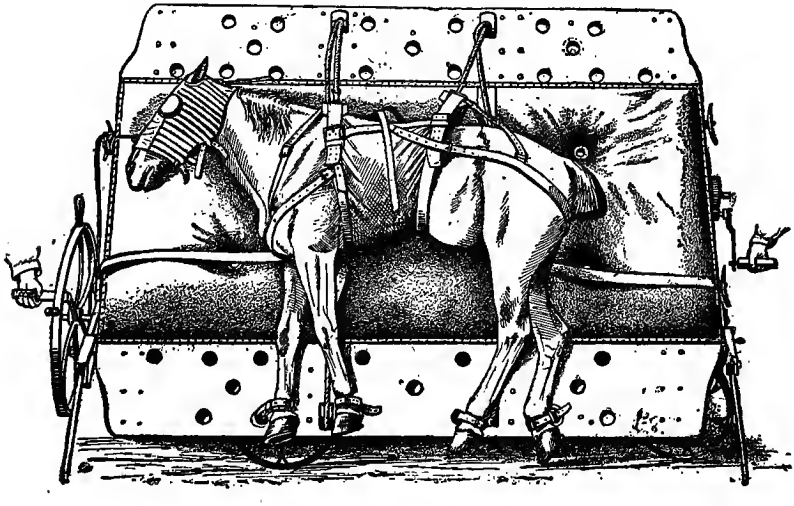


Fig. 18.—Daviau's apparatus.

is easy then to unloose the legs and secure them to the bars or cross-pieces. The operator can thus operate sitting down; the leg of the animal is firmly secured; there is no dust as with the straw bed; the

asepsis is very easy. In raising the animal, the end of the great chain is passed through the middle eye of the lever, the crank is put in motion, and the apparatus, gradually raised, returns to its vertical position. The manipulations necessary for changing the position of the animal and turning it over require a long time.

We have said that the means used for a forced recumbent position, no matter how carefully, may be followed by accidents. None is positively safe. Still, accidents are less frequent with the perfected operating tables than with the straw bed on the ground.

Several other tables of American invention are also used to take the place of the Daviau; among them are those of Hodgson & Nagee, Tiffany, Pierce, etc. (T.)

RESTRAINT OF CATTLE.

RESTRAINT OF THE STEER STANDING.

Almost all operations are made with the animal standing. The horns and the hind legs must be guarded against.

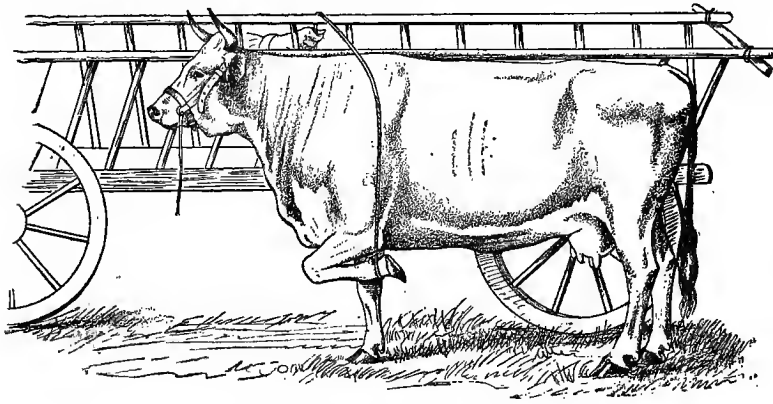


Fig. 19.—Contention of a fore-limb. (Hess.)

1. *Securing the head.* Is it for a simple operation,—examination of the eye, or of the mouth, for instance, —an assistant, standing on the left side of the animal, holds the left horn with his left hand, passes the right between the horns and takes hold of the muzzle, which he squeezes, with the thumb in one nostril, the index and middle finger in the other. Thus the head can be held firm and raised at will.

Another method is that of fixing at the base of the horns a stout rope, successively twisted round the chest and the abdomen, and secured to the base of the tail. Thus the animal is prevented from lowering its head on account of the pain which it inflicts on itself in attempting to do so.

When the animal is hard to control, the head must be attached

firmly to a ring, a tree or a post. Three or four twists of a rope passed round the horns and through the ring are generally sufficient. The rope may also be rolled round the inferior part of the head. Sometimes the animal is placed with another (in the ordinary yoke), as in a team.

2. *Securing the fore legs.* For raising a fore leg, one proceeds as with a horse, using the hand alone, or a rope or strap passed round the fore arm or the coronet.

The animal may also be placed beside a cart, with its head held by an assistant or fastened to the cart. A rope, fastened to the coronet, is passed over the back of the animal and pulled by an assistant on the other side of the cart. (Fig. 19.)

The LeGoff apparatus is also used to control the movements of the ox, as it is those of the horse.

3. *Securing the hind legs.* The anatomic disposition of the coxo-femoral articulation of cattle does not allow kicking straight out

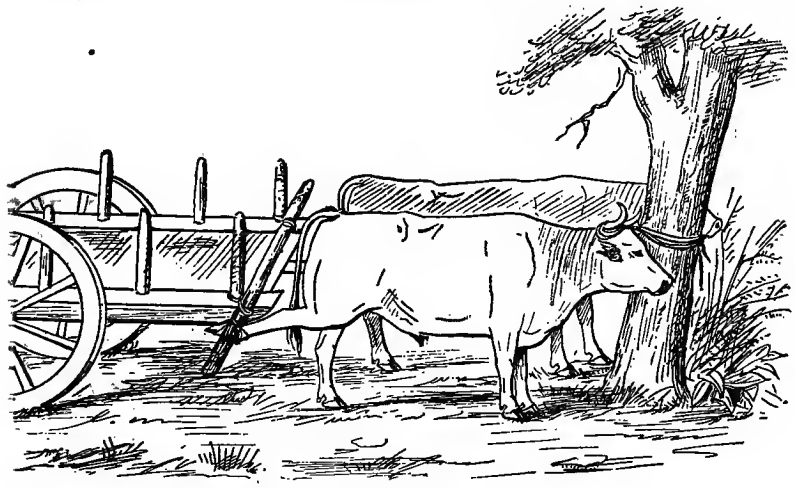


Fig. 20.—Hind-limb fastened to a bar. (Guittard.)

backwards; but kicks from the front and sides are to be feared. To guard against them, both legs can be tied together above the hocks with one or more turns of a rope, which, held by an assistant, can be loosened should the animal struggle much or threaten to fall.

The tail passed in and out round a leg, and pulled backwards, prevents a kick forwards.

A pole, held by two assistants in front of both hocks, is a means frequently used. By resting the pole, one end on the ground and the other on his shoulder, an assistant can push and keep the animal against the wall, and prevent it from kicking forward. Also, one

can raise a hind leg from the ground with a rope which is tied to the fore arm of the same side, or to the horns.

It is at times difficult to hold a hind foot backwards. Several devices for doing it are recommended:

A loop of strong cord is passed above the hock, then twisted with a stick of wood. This means of restraint, which acts as a twitch, gives rise to a sharp pain, by which the movements of the animal

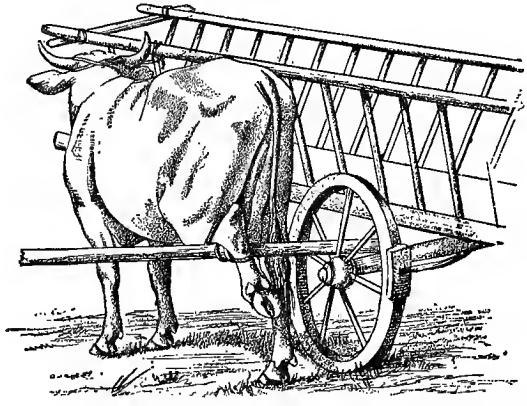


Fig. 21.—Hind-limb fastened to a bar held by two assistants. (Hess.)

are kept under control. When the pressure is sufficient, one end of the stick is carried in front of the leg to be raised and then back of

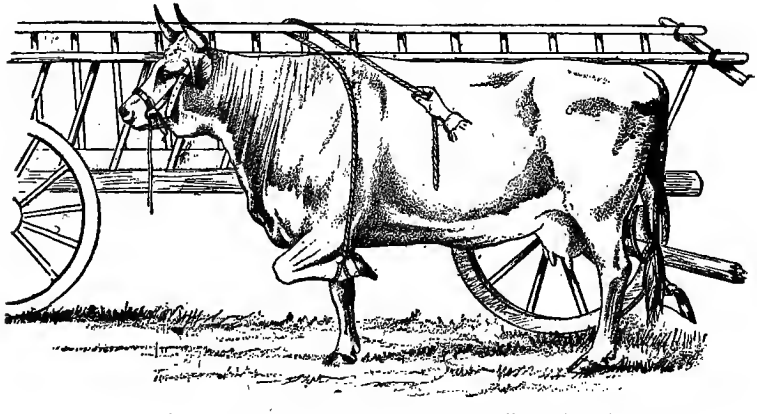


Fig. 22.—Fastening of one fore and one hind limb. (Hess.)

the one on the opposite side. Two assistants, taking hold of both ends of the stick, raise the leg backwards and hold it in place for the operator. Should the animal begin to fall, the leg can be readily let loose.

Put the animal in a yoke with its mate, alongside a truck or a cart, in such a manner that the leg to be raised is on the outside; tie both animals to a tree, a strong post, or a ring. Tie a rope in a running knot above the hock of the leg to be raised, and another in the fold of the coronet; an assistant pulls the rope backwards and winds it round the hub of the corresponding wheel of the cart. Another assistant holds the leg up with a wooden bar put in front of the hock and resting at one end on the shaft of the cart.

A simpler method is to use either the rope or the wooden bar alone.

The method of fastening shown in fig. 20 is also a very good way to fix a hind leg.

Another way is to place the animal against the cart, with its head held by an assistant or secured to the vehicle, its body free or fastened with a rope held by an assistant. The leg which is to be raised is secured at the hock with a wooden bar, one end of which is placed between the spokes of the wheel, above the hub, the other held by assistants (fig. 21). If the animal is very restless, or ugly, it can be controlled better by raising the forward leg opposite the one behind which is to be operated upon. A rope fixed round the coronet is then held by an assistant as in fig. 22.

Stocks which are used for horses can also be employed for cattle, a yoke being placed on their head to steady it. A special, narrow stock has been invented by Goiffon, with which the animal is more easily kept quiet.

Restraint of Cattle in a Recumbent Position.

In using small hobbles, which are placed on the coronet or the fetlock, the *modus operandi* is the same as for horses. A thick

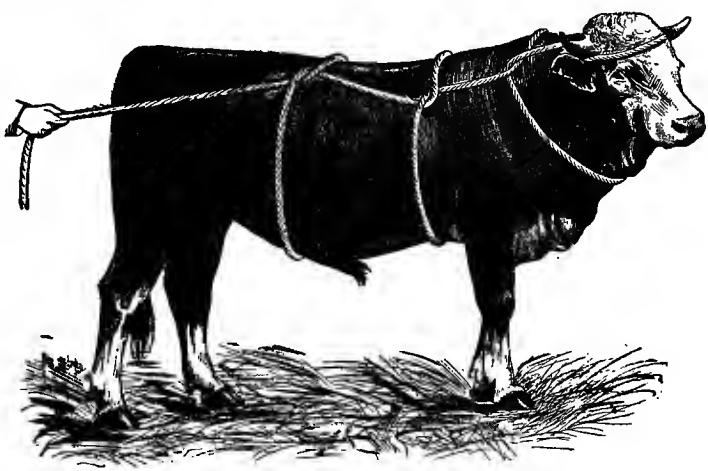


Fig. 23. Throwing of an ox. (Rueff.)

mattress of straw is to be prepared to prevent fractures of the horns.

To throw an animal with hobbles, two side lines may be used. With one, both fore legs are brought together as close as possible; with the other the hind legs are treated in the same way. The free ends of both side lines are then passed crossing each other, between the extremities, that of the fore legs backward and that of the hind legs forward. Traction on both ropes in different directions, also on the head of the animal towards the side upon which he is to fall, with a push at his hip, will make him fall down. The ropes are then secured by knots.

The method of Rueff sometimes answers very well. A long rope is tied round the horns in a loop at one end, then carried along the

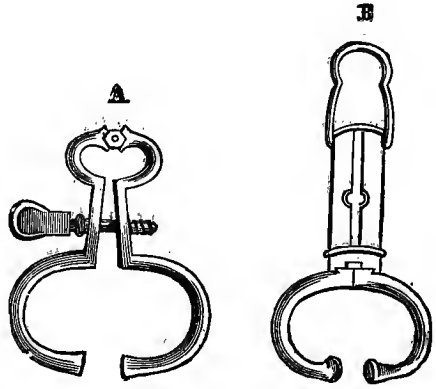


Fig. 24.—Snuffer-nippers. *A*, screw nippers.—*B*, sliding-tongs.

dorsal border of the neck to its posterior third, where it is twisted once round the neck, passed back to the withers, where back of the

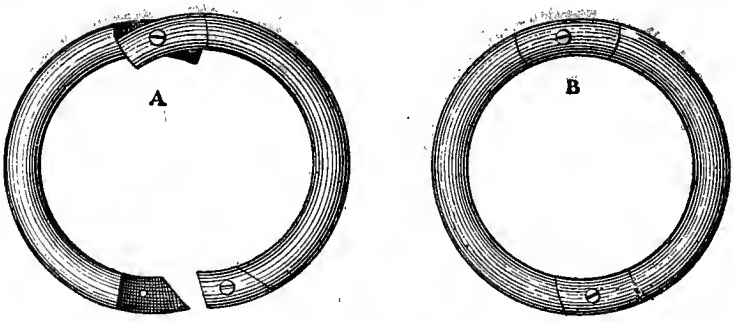


Fig. 25. Nasal ring.—*A*, open ring.—*B*, shut ring.

shoulders another twist is taken, and again in the same way another back at the flank. The end of the rope is then held and

pulled by an assistant, who, as he passes it along the sacrum to the *left* or the *right*, forces the animal to lie down to the *left* or to the *right* (fig. 23).

Cattle are dangerous, especially bulls; but they are readily controlled by nasal pincers or rings. These instruments are common, and extensively used.

The stick which is used to drive the animal is made in various shapes, straight or in the form of an S, as that of Roland. The Vigan apparatus is very powerful and permits perfect control of the most vicious animals.

Fig 26.—Leading stick. (Roland.)

RESTRAINT OF SMALL ANIMALS.

Sheep are easily held in any position. For castration, the sheep is held sitting down on its haunches, the abdomen towards the surgeon, between the limbs of the assistant, who holds in each hand the two legs of one side. In order to carry the sheep, the two legs on both sides are first tied together and then secured by two or three turns of rope.

The *pig* is generally taken hold of by one hind leg above the hock. When the animal is to be cast, another assistant is required, who takes hold of his ear. If the mouth or the throat is to be examined, a speculum is necessary, or the mouth must be kept open with a stick—the handle of a twitch.

Opposite traction with ropes on both jaws may give the same result—especially if assisted by the speculum.

For the *dog*, in all painful interferences, a muzzle or a band wound round the jaws and fastened behind the ears, is to be used. Important operations ought to be performed on a table. Dangerous dogs and those suspected of madness are held with long nippers, the curved jaws of which grasp the neck.

For castration and other operations performed on cats, the animal is held by the assistant, taking it by the skin of the neck in one hand and that of the loins in the other, and keeping it flat on the table by gentle pressure. The cat may also be placed in a narrow sack, in the leg of a boot, or partially wrapped up in a blanket.

Besides the wounds of the skin, and the bruises of subcutaneous structures, one may observe as *accidents* which are liable to follow *castings*. *muscular*, *tendinous*, or *aponeurotic lacerations ; lesions of large blood vessels and nerves* and their consequent *paralysis ; fractures;* and *luxations.* A strict observance of the rules for restraint and casting may prevent most of these accidents, but there are some

which will take place in spite of the greatest care and attention. The therapeutics of these will be studied in special chapters.

II.

GENERAL ANÆSTHESIA.

The idea of relieving pain is as old as the art of healing. In all ages, surgeons have occupied themselves with the idea of diminishing suffering during an operation.

For a long time their attempts failed; and it is scarcely fifty years since hope of ever succeeding was almost given up. "To avoid giving pain in operation," said Velpeau, "is a dream that cannot be realized: sharp instrument and pain are, in operative medicine, words that do not present themselves one without the other; their union must necessarily be admitted." A few years later the dream was a reality. On the 14th of October, 1846, Warren performed before the students of the Medical College in Boston the first operation with anæsthetics. After putting a patient under the influence of ether, administered by Morton, he removed without the least evidence of sensibility, a tumor of the neck, which required a long and delicate operation. When the patient awoke he declared he had felt no pain. Such was the first important application of the discovery of Morton. It opened the era of Surgical Anæsthesia. (Forgue & Reclus.)

A month later, anæsthesia was known in Europe. Boots and Lister first employed it in England. On the 12th of January, 1847, Malgaigne related to the Academy of Medicine several operations which he had performed without the slightest pain to his patients. Facts, favorable to the method, soon were coming from all directions. During the year 1847, veterinarians experimented on animals. Renault, Bouley, Thiernesse, and Rey published the first observations showing the advantages that etherization give in serious operations performed on the horse.

At first ether was used exclusively. Objections were made to it on account of its great volatility, inflammability, and its strong odor, which incommoded the surgeon or his assistants. To palliate these inconveniences a special apparatus of inhalation had to be used. On the 10th of November, 1847, Simpson made known the anæsthetic properties of chloroform; resting on the results of fifty operations, he declared it superior to ether. From comparative trials made with the two products, chloroform won; and it is chloroform that has generally been used up to the present time by humane surgeons. Ether, however, always has its supporters and its own uses. If chloroform is less volatile, less objectionable in odor, and less

combustible, if its action is quicker and more powerful, it is also more dangerous than ether. The latter brings on more slowly a sleep which is not so deep, it gives rise to a state of excitement more marked; but well administered it is almost always harmless.

In later years, other substances and other processes have been recommended to obtain narcosis in various domestic animals as subjects. A mixture of ether and chloroform, administration of ether by way of the rectum, of morphine, with chloral injected into the veins, rectum or peritoneum, or of chloroform with morphine and atropine, benzine, hypnone, urethane, paraldehyde, bichloride of methylene or amylene, have been recommended. For cattle, only alcoholic liquors in large doses can be used, as otherwise, in cases of accident from the operation, the meat could not be used by the butcher.

In *general anæsthesia*, the patient is put into a more or less deep sleep. But it is not always necessary to act upon the whole physical system; on the contrary, one may numb only a given part of the body upon which the operation is to be performed. For *local anæsthesia* the principal agents are: cold (snow, ice, cooling mixtures, or the nebulizing of some liquids), cocaine, stenocarpine, sparteine.

The use of anæsthetics is more limited in the case of animals than in the case of men. No doubt we ought to endeavor to spare our patients pain; but, generally, our interference must be with as little cost as possible; and also narcosis has its dangers. With means of restraint at our command, we can perform almost all operations without having recourse to the use of anæsthesia. This is useful, however, in some cases, to diminish or prevent struggles and sudden movements of the animal at the time of the operation. The struggles and motions of the animal at times render impossible the performance of some manipulations (reduction of hernias, distocial labors); at other times they may give rise to serious accidents when the hand alone or holding in it a sharp instrument moves about in a region, delicate on account of its anatomical disposition, as in intra-abdominal operations. Anæsthesia is also useful in delicate operations upon the eye or its surroundings, and in all serious operations upon well bred animals, whose struggles are peculiarly violent. Möller recommends it for castration of horses whose backs are short and powerful in muscles. With ruminants anæsthesia is generally used only in difficult labors. In carnivora, especially dogs, the principal uses are in laparotomy, distocial deliveries, amputations, and some operations on the head.

Among the principal cases to be noted which do not admit of the use of *general anæsthesia* must be mentioned: 1st, *Diseases of the heart* (valvular diseases or myocarditis, dilatation, hypertrophy).

2d, *Diseases of the respiratory organs* (emphysema, chronic pneumonia, and pleurisy). These affections predispose to rapid and to slow syncope. Ether seems to be the chosen anæsthetic for animals suffering from emphysema or from dilatation of the right side of the heart; chloroform does better for affections of the left side of the heart; chloral is the most advantageous when there are intermittent effects. (Arloing.)

For bloody operations upon the face (sinuses and nasal cavities) if anæsthesia is used, the head must be secured so as to assist the flow of the blood outwards; one must prevent its running into the respiratory tract, where it will give rise to suffocation.

Narcosis being the result of the special action produced directly upon the nervous centers by that which gives rise to it, there is one indispensable condition to its realization, viz., the reception on these centers of a sufficient quantity of the anæsthetic used.

While some fixed anæsthetics may be administered through various agencies (veins, mucous or serous membranes or subcutaneous cellular tissue), volatile anæsthetics, to produce all their effects, must enter by the respiratory mucous membrane. Injected into the organs or into the veins, the former run through the pulmonary capillaries without sensible loss and act in mass upon the centers; the others escape, in great proportion, through the walls of these blood-vessels, and what remains in the arterialized blood is not sufficient to produce anæsthesia. On the contrary, if these volatile agents are introduced in the shape of vapor into the respiratory tract, they penetrate, in great part, into the blood which goes down to the left side of the heart, and this quantity, thrown intact into the arterial tree, rapidly produces anæsthesia, which soon becomes complete.

Thus directly carried in the respiratory tract, anæsthesia gives rise to a series of phenomena, following one another in regular order. The progress of anæsthesia may be divided into three periods:

1st, That of *excitement*; 2d, that of *anæsthesia, anæsthetic tolerance,* or the *surgical period*; 3d, that of *collapse* or *intoxication.*

The first, or period of *excitement,* due to the action of the anæsthetic vapors upon the ends of the nerves of the mucous membrane of the superior respiratory organs (nasal cavities, larynx), and again, to the action of those vapors upon the nervous centers themselves, is characterized by disturbance of the sensibilities, by restlessness, and by the hyperæthesia of the organs of sense. Violent reactions take place, the respiration and circulation are accelerated, the mucous membranes congested, the pupil dilated; but soon the heart becomes slower in its movements; the respiration more regular, easier and slower; the pupils contract, the restlessness subsides, sleep begins. During this first period, anæsthetic vapors may give rise, in those so

predisposed, to *respiratory syncope*, *cardial syncope* or *asphyxia* by *spasm of the glottis*.

The period of *anæsthesia* is characterized by arrest in the activity of the nervous centers, cerebral lobes, spinal cord and mesocephalon. The patient is in an artificial sleep. The excito-motor centers are paralyzed, the muscles in a state of relaxation; the legs, when raised, fall inert upon the ground. Respiration is slow, the movements of the ribs are limited, those of the flank more expanded than ordinarily. The heart becomes accelerated as soon as its moderating center is paralyzed, but the pulse remains regular and full until the stage of intoxication is reached. The eyes stare, the pupils remain contracted and immobile. As sensibility passes from the various organs, reflexes cease to take place in them.

The disappearance of sensibility does not take place simultaneously in all the tissues nor in all regions; it successively progresses to the organs of spinal sensibility — the legs and trunk — to the organs of sense, to those under the influence of nerves rising from the bulb, and at last to those controlled by the great sympathetic nerve system. It is on the nasal, buccal, ocular mucous membranes and towards the genital organs that the last reflexes are observed. At times, when anæsthesia seems complete, the first cut of the bistoury given in a diseased region, may give rise to a reaction; this is due to the fact that some altered tissues, very sore, remain still the seat of a peculiar sensibility, while all the other tissues round them are asleep. When the interference is to take place upon inflamed parts, the operative zone may then remain the "*ultimum dormiens*," the last to lose its sensibility under the action of the anæsthetic. As soon as the narcosis is complete, all that is necessary to keep it up is to continue the administration, in small doses, of the agent used; with large doses, anæsthesia will soon pass to the third period.

Produced by the absorption of too large a quantity of anæsthetic vapors, the period of *collapse* or *intoxication* has for principal signs: the more and more marked slowness of respiration and of circulation and the sudden dilatation of the pupils; respiratory movements are limited and stop at intervals; the cardiac systoles are reduced, the pulse is small, soft and irregular. Finally the bulb, "*ultimum moriens*," is intoxicated, respiration stops, the heart ceases beating. Death takes place by respiratory syncope.

Whether ether, chloroform, or other agents are used, the phenomena of anæsthesia present several peculiarities which ought to be known. With ether, we have said, the period of excitement is more marked and lasts longer than with chloroform. With some fixed anæsthetics, the period of excitement is suppressed or scarcely marked. If the mode of the special action of chloral is yet to be

discussed, every one knows that this agent injected into the veins, produces immediately a deep anæsthesia, without a period of excitement. On the contrary, morphine salts give rise at times to a strong excitation which lasts several hours. But these differences observed in the progress of anæsthesia, produced by ether, chloroform, or chloral, are more interesting to the physiologist than to the practitioner. What interests him is the degree of toxicity of these agents, and the dangers that they present to the patient. And of all general anæsthetics there is no one which is free from danger. Even in veterinary surgery, where their use is yet so limited, they all have several records of death laid to their account.

ANÆSTHESIA OF THE HORSE.

ANÆSTHESIA WITH ETHER.

This is the anæsthetic mostly used in France for horses. It is administered with a sponge, with a ball of oakum, or with a compress. In giving the ether in progressive doses, if necessary, suspend the inhalations at given times; stop them or considerably reduce the dose as soon as anæsthesia is obtained; especially during the time that it lasts, watch the respiration and the reflexes. Such are the principal rules to follow.

The patient, with an empty stomach, is cast, having been relieved of everything that might interfere with respiration, or press on the throat, the lower border of the neck, or the thorax.

It is preferable to use a compress twenty centimeters square, which is thrown over the nostrils. An assistant pours, in small quantities, the ether on the compress, which is kept more or less close to the nose, as the anæsthetic is to be allowed to penetrate with greater or less force.

The mucus of the superior respiratory organs becomes intolerable; for this reason, the first vapors of ether give rise to more or less excitement, the horse whinnies, struggles sometimes violently, the respiration and the circulation become accelerated. These phenomena last sometimes from ten to twenty minutes. In the first stage of anæsthesia a whirling round of the eyes is observed. Upon some horses the eyelids close and open after narcosis is completed. After the period of excitement is passed, if respiratory or circulatory troubles manifest themselves, if the respiration becomes accelerated or now and then partly suspended, if the pulsations are small, increased, irregular, or intermittent, the inhalations must be suspended at once.

The disappearance of sensibility, the muscular inertia, the character of the pulse and of the respiration, the changes of the pupil, the persistency or the arrest of the palpebral reflex, permit one to recognize the extent of the anæsthesic sleep. Complete narcosis is

especially characterized by the disappearance of conjunctival reflex and atresia of the pupil. When anæsthesia is carried to that extent the touching of the conjunctiva and of the cornea no longer stimulates the action of the orbicular palpebral—the last reflex of animal vitality. For this reason it is considered by all surgeons as the true regulator of anæsthesia. When it has ceased to be present and as long as it remains absent the inhalations must be suspended, to be renewed again as soon as it reappears. This sign is of the greatest value, for it characterizes complete anæsthesia, and the moment it appears the case is known to be yet far from the period of toxic accidents. The variations of the pupil give also useful indications. As anæsthesia progresses, the pupil, which had dilated (mydriasis) in the period of excitement, contracts (myosis); it remains narrow and immovable as long as the sleep lasts, and slowly dilates again as sensibility returns. Its sudden dilation during an advanced stage of anæsthesia is a sign of bulbar intoxication, and threatens syncope.

When palpebral reflex has ceased and the pupil is contracted, sensibility has disappeared and muscular relaxation is complete. If respiration and circulation take place in a regular way, anæsthesia may be continued for a long time without danger, by adding now and then new doses of ether.

The operation ended, the hobbles are removed from the patient, he is left to himself until he wakes and gets up.

In order to avoid the waste of ether, which is very volatile, the apparatus of Junker, used by some to administer chloroform, has been recommended. In its simplest form this apparatus consists of a graduated glass containing the anæsthetic, and closed with a cork perforated with two holes, through which are introduced two bent glass tubes. One of these, dipping in the liquid, carries on the other end a Richardson bellows (s); the other tube, which is shorter and does not reach the liquid, carries at the other end a pear-shaped ball (r), which is introduced into the nostril. (Fig. 27.) As soon as the Richardson bellows is squeezed, air is pushed into the liquid and loaded with anæsthetic vapors and bubbles, and is carried to the respiratory organs, without waste, through the other tube. Narcosis, however, is quite difficult to obtain with this apparatus, even in using one for each nostril. To make the instrument more portable, the glass tubes have been replaced by metallic ones, and the graduated glass has been provided with a metallic hook, to hook it to the button holes of the assistant who administers the anæsthetic. Inhalers with valves were discarded long ago. Leather muzzles, metallic masks, sacciform inhalers, are less in use than compresses.

Often to produce sleep a large quantity of ether must be administered—250 to 500 grams. and even more. The waking up with ether

is also slower than with chloroform. The animal remains stultified for a longer time. These disadvantages are compensated by a smaller liability to injurious effects.

Although less dangerous than chloroform, ether is not harmless, as pretended by some. In human surgery, though less used than chloroform, it counts numerous fatal cases. If Ollier, out of 40,000 anæsthetic operations at the Hotel Dieu, of Lyons, has not one single death to record, it is because of his "happy luck" (*série heureuse*).

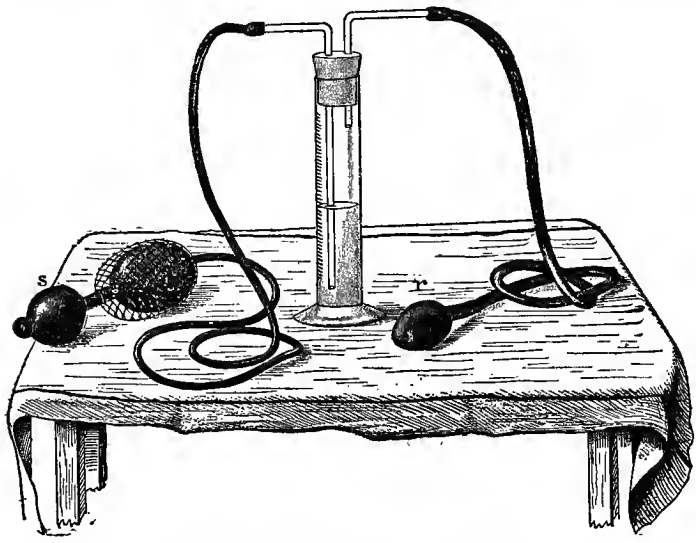


Fig. 27.—Inhaler for etherization or chloroforming.

In Lyons itself, from 1857 to 1878, there have been six deaths due to ether. (Vallas.)[1] The statistics of Gürlt, which we shall consider later, show that, with ether, cases of death have been fifteen times less numerous than with chloroform.

Anæsthesia, by introduction of vapors of ether into the rectum, tried first on animals (Dupuy, Thiernesse), was highly recommended for man by Pirogoff (1847), and recently by Daniel Molliere (1884). It has been recommended by Cagny for horses, especially to produce in them a certain degree of sleepiness so as to diminish some of the dangers of casting, or permit the execution of simple operations in the standing position. The *modus operandi* is simple. A bottle full of ether has on its mouth an India rubber tube which is introduced into the rectum. The bottle is put into a water bath at 50°. The evaporation begins at once; the vapor enters the rectum and is absorbed by the mucus. Thirty to fifty grammes of ether are sufficient. Experiments have failed to confirm the advantages claimed for this method. Often, instead of the semi-anæsthesia which one intends

(1) Lepine, Semaine Medicale, 1878, p. 301.

to produce, violent reactions take place, and powerful expulsive efforts may bring on *prolapsus recti*. In man, some cases have been seen complicated with cyanosis, collapse and true asphyxia.

This treatment is so uncertain in its effects and has such serious inconveniences and even dangers, without any real advantage, that it has never found favor or been adopted.

Anæsthesia produced from a combination of vapors of ether in the rectum, and morphine and chloral, is slow in its effects and not practical.

ANÆSTHESIA BY CHLOROFORM.

When one wishes to obtain a rapid and complete anæsthesia in a horse he must use chloroform. It is not so dangerous for solipeds as it is claimed to be. Möller, who employs it exclusively, has anæsthetized hundreds of horses without a single accident. He has produced narcosis in horses with chloroform and made numerous experiments, of which he gave an account in the first volume of the *Monatschifte für praktische Thierheilkunde.*

In those experiments, Möller has inquired into the practical value of the method, the dangers to which those operated upon are exposed, the time required to produce the narcosis, its duration, and the quantity of anæsthetic required. He has studied the influences that, from these various points of view, the weight, the breed, and the age and sex of animals might have.

Comparing the results obtained in a list at first of 126 horses (31 stallions, 38 mares, and 57 geldings), all of which were anæsthetized until arrest of ocular reflex, he finds that the average quantity of chloroform used is 110 grammes for each subject, about 25 grammes for every 100 kilogrammes of the weight; that the time required to produce narcosis has been in average 20 minutes; and that its duration has been also 20 minutes. In colts 1 and 2 years old, anæsthesia was obtained in 7 to 8 minutes with 15 to 20 grammes of chloroform. It was complete in 7 minutes, using 35 grammes of liquid, with one 4-year-old horse, with 3 others in 8, 9, and 10 minutes. With 12 animals it was not complete until after 30 minutes; with 4 it required 35 to 40 minutes. It required 18 minutes on the average for stallions, 19 for mares, 22 for geldings. While 7 horses were anæsthetized, using 50 grammes, with 18 (5 males, 4 mares, 9 geldings) it took 150 grammes; an adult mare required 240, and a thoroughbred stallion received 250.

In 28 horses which received 50 centigrammes of morphine in hypodermic injections half an hour before the administration of the chloroform, anæsthesia was obtained, in average figures, after 15 minutes with 95 grammes. For 8 horses, ether and chloroform were

mixed together. This mixture required 210 grammes and half an hour to produce sleep. No noticeable difference could be observed by using chloroform of various productions.

Most of the animals which received morphine and chloroform exhibited manifestations of greater excitement than with chloroform alone or mixed with ether. Like Möller, Harms recommends chloroform for anæsthesia of horses; he kept, with 128 grammes, during two hours, a large horse in a complete state of muscular resolution.

While chloroform, well prepared and preserved, and thoroughly pure, rapidly produces sleep, if it is impure or loaded with chlorine, anæsthesia is slower, less complete, and full of starts; and syncope is to be feared. To avoid alteration of the chloroform, a small quantity of ether should be added to it, and it should be kept in blue or yellow glass corked bottles, in a dark place.

Chloroform is administered, as ether is, with a sponge, a ball of oakum, or a compress. A method *rapid* or *powerful* in its action is dangerous and should be rejected. A slow and easy method, which consists in allowing the entrance of a mixture of air and vapor of chloroform, is the only one to be recommended. The assistant must pour the anæsthetic very slowly, drop by drop (2 or 3 in each second). From time to time the nostrils and the pituitary membrane are wiped off with a cloth or some wadding to prevent the irritating effect of the chloroform. With the same object vaseline can be applied on the nose. Several authors (Roux, Gresswell, Föhringer, Zangger, Hirzel) have recommended the use of special apparatus; but most of it is dangerous, since it prevents the entrance of the air. It is not necessary to suspend the inhalations from time to time, if the chloroform is poured out drop by drop.

The period of excitement lasts only a few minutes; in some subjects it is scarcely observed. Soon the animal goes to sleep, into a much deeper one than with ether. By repeating the inhalations anæsthesia can be prolonged for an hour, an hour and a half, or two hours, without any dangerous appearances.

When there is a cessation of the chloroform-giving after it has been administered for a long time, temporary arrests in the respiration may be manifest. Möller has seen them lasting 30, 40 and 45 seconds. Slapping of the lips and the cheeks with the hand or a wet cloth is sufficient to stimulate reflexes and the return of respiration. Some subjects seem to possess a peculiar sensitiveness to chloroform; with them, the first vapor gives rises to great excitement and the progress of anæsthesia is somewat singular. A few fatal cases have been recorded, many others have not been; but, with few and very rare exceptions, pure chloroform does not "kill" except when badly administered, or given to animals having cardiac or pulmonary affections. At the *post-mortem* examination of a horse

that had died during the administration of chloroform, Kemp[1] found an enormous hypertrophy of the heart and a valvular endocarditis with aneurism of the aortic sigmoid valves. Following chloroformic narcosis, inflammatory lesions of the pituitary membrane and of the mucous membrane of the sinuses and also pneumonia have been observed. (Jacobi, Ries.)

In man, cases of death during anæsthesia by chloroform are rare, none having ever been observed by the surgeons who daily perform many operations in the hospitals. König has given it to 7000 patients and Nussbaum to 15,000 without a single accident. When Billroth lost his first patient, he had already used it without harm in 12,500 cases. General statistics from German surgeons, however, show more serious losses: 99 deaths out of 285,380 persons put to sleep, or 1 for every 2,880. At the last German Congress of Surgery, Gurlt reported from 163,490 cases 61 deaths, an average of 1 in 2,680. From 32,725 chloroform cases, there were 17 deaths, 1 for 1,924; when a mixture of ether and chloroform was used, the mortality was 1 in 8,014; when ether, 1 in 26,268.[2] Lépine says that, taking into consideration the number of accidents unpublished, "it can be assumed that there is at least one case of death out of 1,200 where chloroform is used."[3] On that amount Körte, Landau, Vogel,[4] Poncet, Augagneur, Gangolphe[5] have tried to have the use of ether prevail.

Graded mixtures of air and chloroform (method of Clover and P. Bert), recently recommended by Dubois, require the use of special apparatus, which is not used for animals.

The *Combination Method*—inhalations of chloroform after *injection of morphine and atropine*—recommended for dogs by Dastré and Morat, can be used for anæsthesia of solipeds. To a horse of middle size an injection of 10 or 15 centigrammes of muriate of morphine and 5 milligrammes of sulphate of atropine, in a solution of 10 grammes of distilled water, is given. Half an hour after the injection, the animal is thrown and the administration of chloroform begins; anæsthesia takes place rapidly. In the experiments that we have made with Desoubry, it was obtained in about 7 minutes. The average dose of chloroform required was about 65 grammes. The same substance administered alone would not produce narcosis in less than 15 minutes; the average quantity required would be 120 grammes. Non-appearance or diminution of the period of excitement, and the certainty of avoiding cardiac syncope, are the principal advantages of this method.

[1] Kemp, *American Veter. Review*, 1883, p 498.

[2] Gurlt, *Deutsche med. Zeitung*, 1894, *Berlin. Thierarztl. Wochenschr.*, 1894, p. 357.

[3] Lepine, *Semaine Médicale*, 1894, p. 301.

[4] Korte. Landau, Vogel, *Ibid.*, 1894, p. 62, 111, 126.

[5] Poncet, Augagneur, Gangolphe, *Mercredi médical*, 1894, p. 211, 225, 247.

ANÆSTHESIA WITH CHLORAL.

As an anæsthetic for the horse, chloral is used alone, in intravenous injections or associated with hypodermic injections of morphine and administered in rectal enemas.

Intravenous Injections.—Investigations of Oré and of Vulpian have shown that a 1—3 or 1—5 solution of chloral injected in the venous apparatus, produces a very rapid complete anæsthesia. This method, declared dangerous by Colin, which surgeons for mankind (Gosselin, Trélat, Lefort) have immediately condemned, has been recommended in France and in Denmark for the horse, on which an intravenous injection is easily made at the jugular.

This method, studied in 1875 by Humbert, who succeeded in the case of a great number of animals, without an accident, and recommended by him in 1884, is excellent for producing a deep narcosis in horses used for experiments or for the practical services of surgery (Nocard). The apparatus of Dieulafoy is used with a filtered solution of 1—10, 1—15 or 1—3, which is injected into the jugular in variable quantities, according to the subject. When fresh, the solution is neutral; if it becomes acid, a small quantity of carbonate of soda should be added to it.

When an intravenous injection is applied for a therapeutic purpose, it requires a somewhat delicate management. The rules of antisepsis—disinfection of the region, asepsis of the trocar or of the needle—must be strictly observed. When everything is prepared, an assistant presses the vein at the lower end of the jugular groove, the operator stretches the skin towards the head with one of his hands and with the other pushes firmly into the dilated blood-vessel, a hollow needle, or a fine trocar, held very obliquely downwards and backwards. Humbert advises the introducing of the needle by two steps: he perforates the skin first, dilates the vein, and then runs through into it; when the operation is done with the animal standing he prefers the right jugular to operate upon. The escape of blood through the canula, after the trocar is withdrawn, indicates that it has penetrated into the vein. An assistant then holds the canula in position. The operator at this moment connects the mouth of the canula with an India-rubber tube, fitted to the syringe holding the fluid, and slowly pushes into the vein the quantity which is to be injected. This done, the tube is removed, a little blood escaping washes out the cavity of the canula, which is then retracted suddenly without raising the skin. Colin indicates as an anæsthetic dose 20 or 30 grammes of chloral; Arloing, 25 to 50 grammes, Nocard, 10 grammes for every 100 kilogrammes of the weight of the animal. Anæsthesia follows almost immediately; it is more or less profound, and varies in duration according to the chloral injected.

In a few moments the animal sleeps, the immobility is complete, the muscular relaxation perfect, the mucous membranes have a slight cyanotic tinge, the respiration and circulation, disturbed for a moment, return to their normal rhythm. The wakening is slow; the subject remains stupefied for some time, and in some instances is seized with a general trembling. After a lapse of time, varying from half an hour to two hours, the animal gets up staggering, very weak in the hind quarters; comatose manifestations may last for one or two hours after.

When the dose injected has been too large, or the subject is very susceptible to chloral, the sleep is very deep, the mucous membranes become darker and darker, the pupil is dilated, respiration and circulation become slow, the temperature lowers, and death may follow.

If the operation has not been done antiseptically, if the vein has been run through and through, or torn during the operation, and if by any chance some chloral has escaped in the perivenous tissue, it is rare good luck if serious accidents do not follow. Almost all the veterinarians who have tried this method have seen complications of phlebitis produced, and so have given it up. Phlebitis appears generally from the second to the fourth day; it is manifested by a swelling of the jugular groove—a swelling which, sometimes limited and sometimes diffused, ends in suppuration; frequently, there are necrotic lesions. In one case we have seen the vein destroyed and sloughed away throughout almost the whole extent of the neck. The vaso-dilating action of the chloral has also been objected to, as it increases hemorrhage in bloody operations. Though it has been but little used, chloral, like other anæsthetics, has its list of fatalities. Möller has killed several horses by injecting chloral into their jugular in doses of 50 grammes. Doubtless one may say that this was too large a dose, as long as the weight of the animals was not known. In 1889, one of our confrères asked us to assist in firing one of his horses. The animal being very nervous, it was agreed to give it chloral by means of an intravenous injection. The dose used was not above 10 grammes for each 100 kilogrammes of its weight. During the first part of the operation the horse had some slight reactions. After fifteen or twenty minutes, when the operation was almost finished, respiration stopped, and a few moments later, notwithstanding the methodical pressure applied upon the thorax to guard against asphyxia, the animal died.

If intravenous injections, performed aseptically by experienced hands, is declared harmless, it has unfortunately given to many practitioners such results that they had to give it up. "In the case of man," says Dujardin-Beaumetz, "the serious accidents which have occurred have forced this procedure to be abandoned."[1] Peuch de-

1. DUJARDIN-BEAUMETZ.—*L'art de formuler*, *p.* 41.

clares that it will remain "a procedure confined to the laboratory;" Trasbot and Möller condemn it; and for ourselves, we have wholly restricted its use to patients used in our surgical experiments.

Chloral and Morphine.—To diminish accidents resulting from the intravenous injection of chloral, Cadéac and Mallet have proposed to bring about anæsthesia by associating it with morphine. According to their experiments, complete anæsthesia is brought about by injecting into the subcutaneous conjunctive tissue a solution of 80 centigrammes to 1 gramme of muriate of morphine, followed in 10 minutes by a rectal injection of 80 to 100 grammes of chloral.

Narcosis is not always readily brought about. It takes place slowly, and is at times preceded by a somewhat long period of excitement. Esser advises this means in cases in which the use of chloroform is prohibited.

Inhalation of the vapors of chloral does not produce anæsthesia, or even sleep. Subcutaneous injections of chloral in aqueous solution give rise to diffused gangrenous abscesses with abundant suppuration. Administered in sufficient doses (40 to 50 grammes per mouthful), in weak solution, chloral gives rise to numbness, drowsiness, and inco-ordination of movements, but no complete anæsthesia. This process may, however, be used advantageously in ordinary practice. (Harms.)

ANÆSTHESIA WITH MORPHINE.

For horses, subcutaneous injections of muriate of morphine have been recommended to produce drowsiness or a slight anæsthesia which will permit the performance of some operations upon animals standing up. According to size, 20 to 50 centigrammes are injected. The doses of one, one and one-half and two grammes (Gürlt) are useless. In some animals, morphine brings on drowsiness, numbness and a muscular relaxation more or less marked; some animals which are nervous, restless, or dangerous, thus become quiet and easy to handle; but with others, the object is not reached even with large doses, and phenomena of excitement, which may last several hours, will occur. The patients are very restless, give themselves to violent struggles, rear, shake their heads, push them against the wall as in indigestion complicated with brain troubles. We have seen these manifestations last for several hours. Many practitioners have observed similar cases. This process is then uncertain in its results, but may be of some benefit; and when the dose is small, is perfectly harmless.

The *bichloride of methylene*, experimented with by Nigotin in anæsthesia of the horse, has proved inferior to chloroform, as were

hypnone, urethane, paraldehyde and benzine. Inhalations of the last agent had brought on a state of excitement, followed by drowsiness after about 10 minutes and afterwards a quiet sleep, which might be continued by renewed inhalations (Harms).

ANÆSTHESIA OF RUMINANTS AND SWINE.

On these animals, few operations are performed with anæsthesia. The experiments of Tabourin and Saunier have shown that ether and chloroform may be administered to the large ruminants without running any greater risks than with other animals. Nigotin thinks ether dangerous for cattle and recommends chloral (50 to 75 grammes) given per mouthful. Harms suggests the inhalation of benzine. But for animals which are to be butchered, when a certain degree of anæsthesia is to be obtained for surgical purposes alcoholic preparations are preferable. For small bovines, the best way is to give them a large dose of brandy or of rum (one-half to one litre). After five or ten minutes, numbness begins, and by degrees becomes more accentuated. Intoxication brings on perfect relaxation of the muscles.

ANÆSTHESIA OF THE DOG AND CAT.

In laboratories, for the performance of the operations necessitated by the study of physiology and experimental pathology (removal of the spleen, of the kidneys, of the pancreas, of the liver, secretion of the stomach, or removal of the thyroid gland), anæsthesia of these animals is often required. But, for surgical operations, these animals are rarely put under the influence of an anæsthetic. Practitioners prefer to operate in private, with the subjects wholly conscious; they thus avoid inopportune surprise and loss of time. Except laparatomy, cæsarian operations, the dislocation or removal of the crystalline lens, or the removal of some malignant growths, operations can be easily performed on dogs without anæsthesia. Even kelotomy is a very simple operation, without narcosis.

Some recommend ether, others prefer chloroform. In the case of carnivorous animals, since respiration takes place through the mouth as well as through the nose, it is dangerous to suppress the former air passage by closing it with a ligature or a muzzle. The dog should be held in a costal position, with its jaws free or kept apart with a speculum; chloroform should be given through the nostrils or both through them and through the mouth, by placing near these openings a pad of wadding or a small sponge moist with chloroform. This process, as in the case of other animals, is not free from danger. Ether is administered in the same manner.

To obtain a more rapid narcosis and reduce the dangers, the

association of morphine with ether or chloroform has been recommended. Möller injects first under the skin 5 or 10 centigrammes of muriate of morphine, and after a short while, etherizes. Cagny administers vapor of ether through rectum. Others use morphine and chloroform.

As in the case of horses, intravenous injection of chloral is dangerous.

Morphine in subcutaneous injections and chloral in enemas have been used with advantage (Cadeac and Malet, Esser, Guinard). Here is the formula of their use :

Muriate of morphia, 5 milligrammes for each kilogramme.

Chloral, 1 gramme.

The objections are the same as for horses,— slow anæsthesia, abundant hemorrhage.

Ch. Richet has recommended intraperitoneal injections of chloral alone or associated with morphine. Injected into the peritoneum, chloral brings, in about 10 minutes, a complete anæsthesia. The injection is made with a syringe of Pravaz sterilized. The intestines escape the needle and the peritoneum supports diluted chloral perfectly.

Muriate of morphine added to chloral produces a longer anæsthesia (about an hour), and is said to be without danger of syncope.

In this method, the doses are :

Muriate of morphine, 2.5 milligrammes for each kilogramme of the animal.

Chloral, 5 decigrammes.

Fröhner has sometimes used urethane, hypnone and paraldehyde.

But the most preferable method with this species of animal is that of Dastre and Morat. It consists in using chloroform after an injection of apomorphine. With the morphine, the excitement of the beginning of anæsthesia is suppressed ; with the atropine, cardiac syncope is prevented by arresting the functions of the cardial moderating center, and of the vaso-motor fibres of the pneumogastric nerve, "the centrifugal road of the syncopal reflex." Here is the method : First the solution of apomorphine is injected under the skin :

Muriate of morphine	2 decigrammes.
Sulphate of atropine	2 centigrammes.
Distilled water	10 grammes.

used in a dose of ½ cubic centimeter for each kilogramme of the weight of the animal.

When this solution has produced its effect (after 20 or 25 minutes), the inhalations of chloroform are begun. Several grammes are sufficient to produce a complete anæsthetic, which lasts one and two hours.

For man, Aubert has recommended the use of the following mixture, which contains a smaller proportion of morphine, and especially of atropine :

Muriate of morphine	10 centigrammes.
Sulphate of atropine	5 milligrammes.
Distilled water	10 grammes.

This solution is also preferable for dogs. Half of a cubic centimeter is an injection sufficiently large for a small-sized dog, one or two cubic centimeters for subjects of middle size, and three or four for large dogs. After 15 or 25 minutes, the chloroform is administered.

By this process, a deep sleep of long duration is obtained—there is no danger of syncope. (Kaufman, Desoubry.)

Cats are very susceptible to the various anæsthetics. Administered in slightly too strong doses, or too rapidly, or for too long a time, there is danger of death.

A simple and easy method consists in placing the animal under a glass bell, where small sponges, or pieces of wadding, moistened with chloroform have been placed. Soon the patient totters and falls; it is taken from under the glass cover and operated upon. This manner of chloroforming is not without danger; it only produces short sleep, and if new inhalations are made, the animal may die.

The process of Dastré and Morat is the best; but as the cat is extremely sensitive to the action of morphine, which produces in it a very strong excitement, the dose must not be above 0 gram. 0005 (instead 0 gram. 005) for each kilogramme. Guinard, who gives the methods mentioned above, has also recommended another which allows one to bring about a long state of narcosis. He injects hypodermically muriate of morphine, in doses of 0 gram. 005 for each kilogramme of the animal; then, as soon as the phenomena of excitement subside (after fifteen or twenty minutes), he places the cat under a glass bell with a few sponges impregnated with chloroform. As soon as signs of narcosis are apparent, the animal is removed from the cover, and the inhalations continued a few moments. Anæsthesia lasting forty-five minutes can thus be obtained. The excitement which attended the taking of the morphine in the beginning reappears when the animal wakes up, and lasts some time.

ANÆSTHESIA OF THE MONKEY.

The veterinarian may be called to perform some operations (puncture of abcesses, removal of tumors, or the extraction of the canines) on monkeys kept in captivity. Some of these animals are so easily handled that anæsthesia with them is useless; but there are others which are strong and dangerous, and which must be

anæsthesized. Chloroform is the best agent to use. This animal is placed in a narrow cage which is covered with a blanket; at intervals of half a minute to a minute, balls of oakum or wadding moistened with chloroform are thrown into the cage; soon the subject becomes benumbed, staggers, falls against the sides of the cage, crouches down; now is the time to take hold of it—it is defenceless. (Percheron.) If the operation is to last some time, a few inhalations of chloroform are given.

It is prudent to replace the animal in its cage until it has recovered.

ANÆSTHESIA OF BIRDS.

Narcosis is easily brought about in birds. Chloroform is more commonly used. The animal is placed under a glass bell, gently raised on one side to allow the entrance of air; small balls of wadding saturated with chloroform are introduced under it. Soon the bird totters and goes to sleep without any symptoms of excitement. Inhalations can be kept up, if the operation is to last very long.

Unless a subject is possessed of an excessive susceptibility to anæsthetics,—one of those "predisposed to syncope," which one comes upon in all species, one may avoid complications and *accidents* by observing the following rules: Give anæsthetics to animals only when they have an empty stomach; use a product pure and free from adulterations; administer the ether or the chloroform slowly so as to allow also the entrance of a certain quantity of air; if chloral is used, introduce the solution also very slowly; and carefully watch the reflexes.

In anæsthesia by ether or chloroform, there are at times, during the period of excitement, spells of coughing and panting for breath; these are of short duration. Yet, at this stage, the irritation of the mucous membranes of the first air passages may give rise to a *respiratory syncope*, which is also possible at the moment when the anæsthetic vapors make their impressions upon the encephalic elements, and later on, by bulbous intoxication. Respiratory syncope is indicated by superficial inspirations, very rapid, or sometimes very slow and incomplete. While the action of the heart persists, respiration can be re-animated by various means: slapping of the lips, of the face, or of the neck, methodic pressure upon the chest, rhythmic tractions of the tongue (Laborde), and artificial respiration. In complete anæsthesia, short arrests of respiration may be observed, which are syncopal in nature.

Like respiratory syncope, *cardiac syncope* is precocious, secondary, or terminal; since it is brought on by the irritation of the pituitary, the sudden action of the anæsthetic upon the encephalon, or by bulbary saturation. It is manifested by repeated, very short, and

later by intermittent arterial systole. As soon as the pulse is irregular and the visible mucous membranes are becoming pale, cardiac syncope is imminent; inhalations must be suspended at once, the head inclined, the respiration kept up, and rhythmic traction upon the tongue performed.

In small animals, during the anæsthetic sleep, it may happen that the tongue, retracted in the mouth, presses with its root against the epiglottis and closes the larynx. Respiration becomes embarrassed, and then its sounds suddenly cease. If this accident occur, tractions upon the tongue must be immediately applied to relieve the larynx.

At the beginning of anæsthesia, in the stage of excitement, alarming symptoms may be manifested (general stiffness, staring eyes, cyanosed membranes, and arrest of respiration), due to the *closing of the glottis* by spasms of the laryngeal muscles. If these symptoms appear, anæsthesia must be at once stopped, applications of cold water must be made upon the head and the face or chest slapped with a cloth dipped in cold water.

Intoxication by the inhalation of too great a quantity of ether or chloroform is not to be feared unless anæsthesia has been badly applied or carried too far.

LOCAL ANÆSTHESIA.

The dangers of general anæsthesia have suggested the idea of finding means by which only the region to be operated upon should be anæsthetized. Continued pressure over the tissues and the mediate compression on the nerves being very imperfect in their result, ice freezing mixtures or nebulization of ether have been successfully employed. Then came cocaine, the use of which has now become general.

Anæsthesia by Cold.—1. *Freezing Mixtures.*—The continued application of cold upon superficial tissues produces in them modifications, which bring on ischæmia, numbness, a diminution, and even an abolition, of sensibility.

During this century cold has been resorted to for the purpose of performing some short operations upon the skin and the first subcutaneous layers, where refrigeration might, without inconvenience, be rapidly realized.

In veterinary surgery it has been resorted to for operations on the lower parts of the extremities. Ice and common kitchen salt are mixed in equal parts or in the proportion of two to one. This mixture is placed in a bag or wrapped in a cloth and applied upon the parts to be operated upon. In a few minutes this becomes cold,

hard, and insensible, especially if, with this application, pressure is made upon the skin.

The surgical action, when it is not too deep, produces no pain and no hemorrhage. But as the anæsthesia is of short duration one must operate quickly.

2. *Nebulization of Ether.*—To produce local anæsthesia upon the operating field a throwing of vapors of ether has been tried. To increase the effects of the ether some was poured over the surface of the skin drop by drop and the evaporation stimulated either by a strong draft of air or by blowing over it with a bellows. Richardson has rendered local etherization more practical by the use of the atomizer bearing his name. (Fig. 28.) With ether at 40° one may obtain with this atomizer a local ischæmia and anæsthesia which permit a painless performance of slight operations (cutaneous dieresis and exeresis). The action of the evaporation is more rapid and

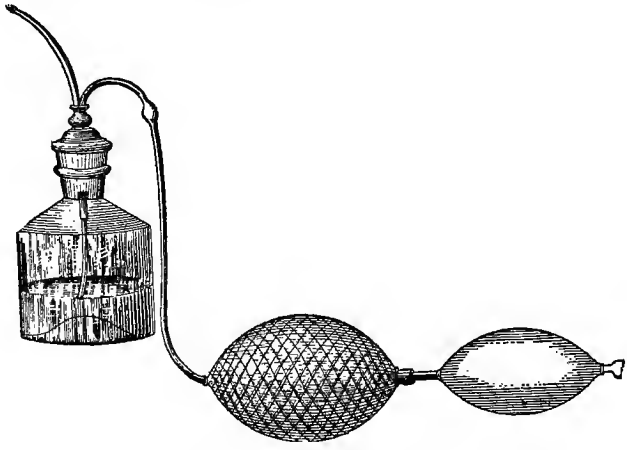


Fig. 28.—Richardson's atomizer.

complete if, before the nebulization, a bandage o. Esmark has been applied. Inflamed structures are quite difficult to anæsthetize. For them freezing mixtures are better.

Sulfide of Carbon possesses no advantage over ether.

Chloride of Methylene, used with much success for man in obstinate cases of neuralgia, has a too powerful freezing action. It renders the skin insensible in a few seconds, often freezing it, and occasions a more or less extensive slough.

Anæsthesia with Cocaine.—In 1862 Schroff had already shown that the lingual mucous membrane could be rendered insensible with a solution of cocaine. The same result was observed by Fauvel in the case of the pharynx. In 1884 Koller recommended it as an excellent anæsthetic for the membranes of the eye and of the larynx. Vul-

pian and Panas made it popular in France. Reclus published some excellent papers on its application. Labat proved that it could be used with benefit for animals.

Cocaine is almost insoluble in water, but most of its salts in any proportion are readily dissolved by it. The most generally used is the muriate of cocaine in solution of 1 per 100. The addition of a small quantity of corrosive sublimate insures the purity of the solution for preservation. We use the formula recommended by Reclus.

Muriate of cocaine	10 centigrams
Sublimate	2 milligrammes
Distilled water	10 grammes

With a few drops of this collyrium dropped between the eyelids the superficial layers of the cornea are rendered insensible in three minutes.

By repeating this process at intervals of two minutes anæsthesia of the cornea, of the conjunctiva, and of the eyelids is complete in less than ten minutes, and lasts for fifteen. The pupil dilates; but, generally, the anæsthesia of the iris is only obtained by an injection made into the anterior chamber. With cocaine, puncture of the cornea and the extraction of foreign bodies incrusted in it are made easily. Five or six injections under the conjunctiva, round the ball of the eye, will permit its entire removal without great pain.

The action of cocaine is not less remarkable upon other membranes. On that account its use is prescribed for painful inflammation of these structures. Subcutaneous and submucous injections of cocaine will remove sensibility from superficial tissues, and permit various operations to be performed. By injections in linear or circular tracts the area of the influence of the anæsthetic can be increased. A long and fine canula, fitted to a Pravaz syringe, is introduced through the skin into the subcutaneous cellular tissue, or, better, into the thick dermis, following the direction of the incision to be made. Then it is withdrawn gradually while the piston of the syringe is pushed in. In this way the solution is diffused in a linear track. (Reclus.) The anæsthetic power of cocaine is increased by a previous injection of morphine.

Cocaine has no action upon nervous cells. It acts exclusively upon the terminal fibres of the sensitive branches. (Arloing.)

Its toxicity varies according to the kind of animal. For dogs, more than 5 to 10 centigrammes are dangerous. Concentrated solutions have no advantages and are dangerous. In every degree of concentration, solutions of cocaine, when they become acid, lose, more or less completely, their anæsthetic properties, which can be restored if the liquid is rendered neutral.

III.

SURGICAL ANTISEPSIS AND ASEPSIS.

Although infectious complications of traumatism have, at all times, occupied the attention of surgeons, until modern times surgical art was powerless to prevent them, because their nature and their particular cause were unknown. In the first part of this century, they were supposed to be due to the action, upon the exposed wounds, of the impurity and vicious condition of the *atmosphere of hospitals*, or of the air *loaded with the miasmas of putrefaction.* The labors of Pasteur and of Tyndall seemed to justify the correctness of this idea, although they showed that it is not the air itself which possesses injurious properties, but the germs that it contains in suspension.

While organic substances exposed to the action of the air enter immediately into fermentation, they do not undergo any kind of alteration in contact with *air optically pure*, which has been filtered through wadding. It is the animated atoms, the germs in suspension in the atmosphere, the *microbes*, which give rise to the decomposition of those substances and to the putrefaction which is developed in the tissues as soon as life has left them. Without micro-germs there would be no decomposition or no putrefaction. Logically, it became evident that the same process ought to take place in wounded structures, exposed to the action of air, and of its germs. The phenomena which characterize septic complications of wounds should be essentially those occurring in fermentations.

The first important researches made for the purpose of preventing these complications are comparatively recent. It was in 1861 that Lister, inspired by the labors of Pasteur upon the subject of fermentation, made the experiments which brought him to conceive of the *antiseptic method ;* and in 1870, A. Guerin, guided by the same discoveries and those of Tyndall, originated the wadded dressing. It is but just to say, that in 1865, Lefort had already said that *contagion* is the great cause of those complications.

Guerin, in the case of wounds, realized the experimental conditions which protect organic matter from the alterations of which the micro-organisms of the air are the agents ; with thick layers of wadding he protected the divided tissues from the action of germs. Lister had for object to destroy, with chemical agents, the microbes which corrupted the wound or which might be deposited in it during the operation ; he rendered the wound aseptic and then protected it by a true germicide obstacle.

Let us first consider the wadded dressing.

At first Guerin did not attempt to obtain immediate union ; he

only tried to reduce to the minimum the secretions and prevent accidents from infections. Hemostasis insured, he washed the wound with tepid water, then with a mixture of water and camphorated alcohol; in some cases he saturated the wound with it, cut the threads of the sutures close to the skin, and then covered the whole with several layers of wadding. In serious operations upon the extremities, those were wrapped up in sheets of wadding superposed in such a way that the leg seemed to be three times its ordinary size. The wadding was then fixed tight with linen bands properly applied; the whole of it was to be sufficiently pressed to give on percussion "a resonance resembling that of the normal thoracic cavity." If, on the following days, the degree of pressure proved insufficient, new bands were applied, and if the dressing appeared to be run through by the serosity of the wound, other layers of wadding were applied over it. This dressing was first left in place for 20 or 25 days; later, it was changed after 12 or 15 days. Generally, when the first dressing was taken off, the wound was granulating throughout its whole extent. After a second dressing, having been left 8 or 10 days, often cicatrization was complete.

Several modifications of this method have been introduced which permitted reunion by the first intention. First, the hemostasis was made more vigorous and the edges of the wound were fixed together with absorbable thread (catgut) placed more or less deeply. Besides its numerous advantages, the wadding-dressing had the disadvantage of concealing from the surgeon the condition of the traumatism. It is true the thermometric observations informed him of the complications likely to occur; but as it sometimes happens that thermometric elevations show themselves in the case of patients whose wounds are doing well, much time was lost, and patients were exposed to complications by uncovering wounds in process of cicatrization. And again, although in protecting the wounds by layers of wadding atmospheric germs were prevented from reaching the divided tissues, those which had already been deposited on them during the operation were not destroyed; and these, though under restraint (*mal à l'aise*), were nevertheless multiplying, often with great rapidity.

Still, compared with the old dressings, the wadded apparatus was an immense advance in the surgical art. It was employed, however, but little; and was obliged to make room for the Listerian dressing, more practical and more trustworthy in its results.

To prevent the infection of the wound, Lister strived to surround it with an atmosphere freed from infectious elements and to destroy the germs of the surrounding aerial layer, those deposited on the surface of the wound, on the hands of the surgeon and his assistants, upon the instruments, the sponges, the compresses, and all objects

of dressing. The wound, free from infectious germs, was covered with material impregnated with an antiseptic, and care was taken to prevent the accumulation of the serosity secreted by the wounded surfaces. As microbicide agents, Lister used especially phenic acid, and in 1 to 20 solution (strong) or 1 to 40 (weak). With the strong solution, he disinfected the instruments, the sponges and the region; and, when the operation was concluded, the wound over its whole surface. The weak solution was used to wash the hands of the surgeon and assistants, to moisten the sponges and clean them during the operation. To prevent the contamination of the wound by atmospheric germs during the operation, a "phenicated cloud" (*spray*), made with a Richardson atomizer or a vapor nebulizer and a solution of phenic acid, was thrown over the field of operation. After the operation, and before the spray was arrested, as soon as hemostasis was obtained, by catgut ligatures cut short to the knot, the edges of the wound were brought together with sutures of the same nature. Drainage tubes were fixed to allow the escape of the secreted fluids, and the dressing was applied.

The region of operation was first covered with a *protective* band of silk, very thin, gummed, and impermeable, for the purpose of preventing the prolonged action upon the wound of the too irritating phenol; above this, phenicated (carbolated) gauze folded in eight layers, the last two having between them an impermeable cover of caoutchouc to prevent the evaporation of the phenol and oblige the liquids secreted by the wounds to run through the whole thickness of the dressing before reaching the outside. All of these were kept in place by bands of carbolated gauze. Since the action of the phenol upon living tissues gives rise to an abundant secretion, the dressing ought to be taken off after 24 or 48 hours, the wound examined, as also the sutures and the drains; if necessary, take these off, and replace them after a thorough washing with a solution of phenic acid, and then a new dressing applied. All of this should be done under the spray. Later dressings more or less frequent were made with the same care; the wound was looked at only when it became painful or when there was a noticeable rise of temperature. Such was the method used for *wounds* in *operations* made upon tissues free from all external contamination.

For recent traumatic lesions more or less irregular, the application of the dressing was preceded by a careful washing made with a concentrated solution of phenic acid (1 to 10). Suppurating wounds required a more complicated preparation; they were first treated with the curette, then very carefully washed with a solution of chloride of zinc (1 to 10). As the irritating action of the phenol was not to be feared, the protective band was dispensed with.

The Listerian dressing extolled by Championniere and Terrier in

France, and by Wolkmann and Billroth in Germany, soon became popular in every country. Everywhere it took the place of the old ones; but, advantageous as it was, it was soon found to have many faults; such as, its many details, and the time required to apply it, its expensiveness, and the toxicity of the phenic acid. Everywhere, surgeons set about improving it, and above all simplifying it, while respecting the principal rules established by its author. For phenic (phenol) acid, Thiersch substituted salicylic acid; Lewin, thymic acid; Kocher, chloride of zinc and sub-nitrate of bismuth; Bergmann, corrosive sublimate; Mosetig-Moorhof, iodoform. The phenicated gauze was replaced by rough netting (gauze) kept in phenol (weak solution) until ready to use (Bardeleben), and by muslin soaked for a week in a strong phenic solution (Bœckel). Neuber proposed to use for drainage, tubes made of decalcified bones, which would be resorbent, irritate the tissues but little, and avoid the too frequent renewal of the dressing. The *protective* band was recognized as useless, and drainage was used only when it was pretty evident that immediate reunion would not take place. The technic of the dressing, the microbicide agents, and the strength of the solution, were all changed indefinitely.

Guerin, holding to the principal idea resulting from the new doctrine, prevented the entrance into the wound of the germs of the air. He was less occupied with the infection through the hands, instruments and objects of dressings; and if he nevertheless obtained good results, he owed them in a great part to "cleanliness," to an excellent habit which he had, before working, of washing his hands and cleaning with soap and camphorated alcohol the region to be operated upon and its surroundings.

Lister's method was more sure, but it also had its imperfections and its errors. Evidently the success which marked the beginning of antisepsis was not exclusively due to phenic acid. To it was attributed a vigorous bactericide action that it did not possess. The belief in rapid and complete disinfection, by phenic acid, of the instruments, hands, and operative field were fallacious. In the process of Lister, as in that of Guerin, what was important was the severe cleanliness of the hands, instruments, and objects of dressing. Notwithstanding phenic acid, say Terrillon and Chaput, "antisepsis would never have come out of its limbus if cleanliness had not helped it to make its entrance into the world."[1]

Protect the wounds from the action of the germs of the air. Such was the great occupation of Guerin, and of Lister himself. But numerous observations have shown that infection of wounds is almost always produced by the hands of the operator or of his assistants, by the instruments, the objects used for dressings, the

[1] Terrillon and Chaput—*Asepsie and antisepsie chirurgicales*, p. 4.

liquids used, and not by atmospheric germs. Contrary to what was taught at the beginning of antisepsis, the air is in reality but little to be feared for the wounded; its microbes, thought so dangerous, are almost harmless. When they fall, scattered upon the wound, the phagocytes generally are sufficient to destroy them; those which are carried into it "in legions" by "the dirty hands," the uncleaned instruments, the unprepared materials of dressing, are much more dangerous. Numerous facts borrowed from veterinary pathology can be cited in favor of the "germ contage." Septicæmia, which in other times burst out so frequently after operations performed in our hospitals, was not due, as was believed, to the deposit of atmospheric germs upon wounds; it was inoculated by the dirty instruments, which were transferred from the post mortem rooms to the surgical amphitheaters without being cleaned, or only after a semblance of cleaning. We can daily violate the old dogma of respect for the sero-sanguineous collections of the horse, because we open them with aseptic instruments. It is the same with the septicæmic spores. How many times those of tetanus have been inoculated by the instruments! To speak only of castration, how many victims have there been to the twisting nippers (*pince à torsion*) whose jaws, notwithstanding "good washings," retained in their rough teeth the dangerous virus.

When the principal mode of contamination of wounds was known, careful attention was given to the disinfection of instruments, of hands, and of the dressing material. Bacteriological researches, and failures in some operations, showed that the disinfection by chemical agents was not always complete, even with the use of concentrated solutions. Organic substances are not easily penetrated by antiseptic liquids; no matter how thin they may be, it is possible that their deep parts remain virulent notwithstanding the continued action of these liquids. Their use was kept up to disinfect the hands and the portion operated upon; then heat and high temperatures were used to sterilize the instruments, ligatures, drains and other objects of dressing.

Passing them through the flame of an alcoholic lamp, immersing them in boiling water, in glycerine, or oil heated to 120°–150°, are the sterilizing modes now most in use. The simplest and most practical is certainly boiling water. It does not give an absolute security, some spores resisting a temperature of 100°; it almost always offers, however, sufficient guarantee.

In hospitals, the autoclave of Chamberland and the dry ovens are very advantageous, the former for sterilization of objects preserved in liquids (120°–150°).

In these last years, while in the old world vigorous antisepsis has been practised and its methods perfected, English and Ameri-

can surgeons have given up bactericide agents to be satisfied with strict cleanliness. They put antisepsis aside for *asepsis*. But this cannot be accepted in veterinary medicine, at least, as a general method. There is no necessity of studying them separately anyhow; they mutually complete each other, and their association is often advantageous. Antisepsis must be applied when the operation may be followed by abundant suppuration, a fistulous tract, or an ulcer, and also after interferences in which union by first intention has failed to take place; its agents are always used to disinfect the part operated upon, the hands, and the instruments, and to prepare the material of the dressing. One is satisfied with asepsis alone when only tissues free from any contamination are to be divided, and when antisepsis might, by their contact, give rise to inflammation, limited necrosis, and intoxication; but although, when one is certain of asepsis, it is useless to place healthy divided tissues in contact with strong antiseptic solutions, very often, during operations, the veterinarian is obliged to have recourse to those solutions in order to purify the tissues accidently contaminated.

Of the two problems, "antisepsis before and during" or "antisepsis before, and asepsis during" an operation, it is the former that we prefer as a general rule in our own practice, where during operations, on account of the conditions in which they are performed, the chances of infection of the wound, of the hands and of instruments are very numerous and difficult to avoid.

Even in human surgery, where strict asepsis can, perhaps, be obtained more easily,—thanks to the places well arranged for it, and to the use of special apparatus,—and where the operator is aided by a selected staff and well-trained assistants, antisepsis has also its advantages. In general, says Terrier, "with a view to greater certainty from an operative standpoint, it would be well always to reserve antisepsis for certain things, even while one should give his preference to the mixed method. . . . Since the organization of our hospitals is so insufficient as it is, the mixed method seems to offer us more security than the pure aseptic process."[1]

Among the agents which give rise to infection in surgery, there are those which assume a single form (micrococci); others have morphological characters which differ according to their stage of evolution (bacilli). While the former are generally rapidly killed by heat and by antiseptic agents, the latter have a resistance to the causes of destruction, which varies according as they are under the form of bacilli or in the state of "germ-corpuscles." When they have become adults, they are easily killed; but under the form of spores, they possess a very great resistance to germicide agents.

1 Terrier et Peraire, "Manuel d'antisepsie et d'asepsie chirurgicales," p. 123.

Some spores (tetanus, septicæmia) are possessed of an extraordinary vitality.

All microbes resist heat and antiseptics much better and much longer in dry than in damp media. An excellent way of effecting their complete destruction, is to expose them to damp heat. While most of the pathogenic microbes may be killed with steam, to obtain the same result with dry heat, a temperature of 130° to 150° is required. With the assistance of moisture, the potency of high temperature and of chemical antiseptics is considerably increased. Submitted to the action of damp heat, most of the adult pathogenic microbes do not stand a temperature of 100° more than a few minutes; boiling water is sufficient to destroy them; also strong antiseptic solutions. Many die at 80°–70°, and even 65°, but to destroy tetanic, septic, and some other spores, temperatures higher than 100° are required.

The following table shows the temperatures at which, in damp media, the pathogenic agents, which are most interesting to us, are killed:

The staphylococcus aureus is killed in ten minutes by a temperature of			58°
— albus	—	—	62°
— citreus	—	—	62°
The streptococcus of erysipelas	—	—	58°
The distemper	—	—	60°
The bacillus of tetanus	—	—	75°
— tuberculosis	—	—	75°
— glanders	—	—	55°
The bacteroids	—	—	55°
The anthrax spores	—	—	100°
The tetanic —	—	—	105°
The septicæmic —	—	—	120°

The *tetanic virus* (spores) is destroyed in 15 minutes with a temperature of 100°; in five at 115°. It resists nearly 10 hours, in a cold, strong phenicated solution (5 per cent.), and for more than three hours in a Van Swieten solution.

Fresh *septicæmic virus* resists 15 minutes, with a heat of 100°; with dry heat it is destroyed in 10 minutes at 120°.

Fresh virus of symptomatic anthrax is destroyed in two minutes by immersion in boiling water. If it is dry, it stands 10 minutes a heat of 120°.

Also, fresh virus of *bacterian anthrax* (spores) is destroyed in a few minutes by heat at 100°—105° if it is dry. To obtain the same result, a temperature of 115° for 10 minutes will be required.

ANTISEPTIC AGENTS.

Let us briefly consider the principal antiseptic agents, and indicate their use and modes of application.

With *phenic acid*, solutions of 1, 2 or 5 per cent. are made. The

strong solution (5 per cent) can be used to disinfect instruments and the operating field, to cleanse abscesses, suppurating surfaces, and to stimulate a slight adhesive inflammation in intestinal sutures (Chaput). It should not be used for wounds consequent on the operations or for recent injuries, where cicatrization by first intention is looked for, because it greatly irritates the tissues, and produces a serious hypersecretion which prevents immediate union. The weak solution (2 per cent) is proper for the washing of recent wounds, and the disinfection of the hands during the operation. A solution at 1 per cent is employed for the disinfection of some mucous membranes and for obstetrical operations.

Bichloride of mercury (*sublimate*) is one of the most powerful chemical antiseptics. Koch has shown that a solution of 1 to 1000 destroys in a few minutes bacteria and most of the spore-micro-organisms. On account of its toxicity, many surgeons use it only for the disinfection of the skin and of the vaginal mucous membranes; they find it dangerous for other membranes and for bleeding surfaces. It may, however, be used in *weak solution* for the washing of wounds made by the operations, or those which are the result of accidents; it irritates less than phenic acid. Its use is not advised for the disinfection of metallic instruments; it blackens them and destroys their polish and their sharpness. Some practitioners, in its place, use the bi-iodide of mercury for obstetrical operations and the oxycyanide of mercury for the preparation of the instruments. (Chibret, Trasbot).

The strong aqueous solution of corrosive sublimate is made as follows:

Corrosive sublimate	1 gramme
Tartaric acid	5 do
Boiled water	1000 do

The weak solution is obtained by adding 1000 grammes of water to the preceding. Solutions of 1 to 3000 or 1 to 5000 can be used for asepsis of most of the mucous membranes. With the lozenges and the wafers of sublimate made use of to-day, nothing is easier than to prepare those solutions extemporaneously.

The *alcoholic solution of corrosive sublimate*—excellent for the disinfection of the hands, and of the operating field—and *sublimated vaseline* are prepared as follows:

Alcoholic solution.

Corrosive sublimate	2 grammes
Alcohol (90°)	1000 grammes

Sublimated vaseline.

Corrosive sublimate	1 gramme
Alcohol	10 grammes
Vaseline	1000 grammes

Chloride of zinc, used by old surgeons for the treatment of wounds of a bad nature, is a powerful antiseptic. In concentrated solution (5 per cent) it rapidly destroys most of the spores (Koch), but is caustic. Solution of 1 in 10 is advantageous to disinfect fistula, abscesses, and suppurating or septic wounds. Socin's paste (50 parts of oxide of zinc, 50 of water, 5 or 6 of chloride of zinc), recommended in Veterinary Medicine by Cagny, forms for aseptic sutured wounds a protective varnish which may be used for dressing. It is especially used for wounds of the head and of the superior parts of the trunk.

Potassium permanganate is also a good antiseptic. Free from all toxicity, it owes its microbicide properties to the oxygen that it gives out. Without irritating action upon tissues, it can be used on all wounds, specially those of the mucous membranes. Soluble in water in all proportions, it is easy of application. In solution of 1 to 1000 it is advantageous for disinfecting the mouth, the nasal cavities, the vagina, rectum and the wounds of cavities (serous). The strong solution is utilized (10 in 100) for injected wounds and for the asepsis of the hands. To remove the discoloration that it leaves, it is sufficient to dip them into a solution of bisulphite of sodium (10 in 100), to which is added a few drops of chlorhydric acid.

Biniodide of mercury, whose germicide power is reported to be equivalent to thirty times that of corrosive sublimate, is used in solution of 1 in 10 or 20,000 for the disinfection of the ocular and uterine mucous membranes. It is not irritating to the hands or to the edges of wounds, and it does not injure instruments.

Iodoform, used for a long time now in the treatment of wounds and *ulcers* (Demarquay, Lallier, Besnier, Féréol) is a costly antiseptic. Its action is slow, but lasting. Both antiseptic and analgesic, it quickens cicatrization of wounds, interferes with the decomposition of fluids that they secrete, and diminishes the soreness. A small quantity sprinkled upon bleeding tissues before they are brought together, does not prevent immediate union. Laid, even in thin layer, in wounds with loss of substance, it keeps them in an aseptic state for five, six or seven days, forming a kind of reserve for constant disinfection. (Forgue and Reclus.) Employed in large quantities upon recent wounds, on subjects provided with adipose tissues, principally obese dogs, it may be dissolved by the bloody secretion, by the fat, and give rise to intoxication. Its inconveniences for veterinary use are its disagreeble odor and its comparatively high price. It is generally applied as a fine powder, but sometimes under other forms. The most used preparations are :

Iodoformea ether.

Iodoform	7 to 10 grammes
Ether	100 grammes

Glycerine emulsion.

Iodoform	10 grammes
Glycerine	100 grammes

Iodoform ointment.

Iodoform	7 to 2 grammes
Vaseline	10 grammes

Iodoform is fixed upon gauze or wadding.

Iodoform gauzes are generally used in antiseptic dressings. They contain 10, 20 or 30 per cent of iodoform. *Iodoform wadding* is used to fill cavities, or in dressings following operations on the vagina.

Di-iodoform, a relative of iodoform, into the constitution of which enter 95 per cent of iodine, while iodoform contains but 69 per cent, is a yellow substance, insoluble in water, but little soluble in alcohol, very soluble in most of the hydrocarbons. It keeps indefinitely without alteration in the dark, but is very sensitive to the action of light. Inodorous and antiseptic, it is one of the most powerful cicatrizing agents known. Its microbicide power is comparatively small. (Maquenne.)

Iodol, less odorous and less toxic than iodoform, possesses similar properties, and is used for the same purposes. Iodol gauze, vaseline and collodion are prepared with it.

Salol contains 40 per cent of carbolic acid. Used as powder, like iodoform, it has the advantage of having no disagreeable odor. It serves for the making of antiseptic gauze and wadding.

Cresyl (creolin) is much used as an antiseptic in Veterinary Surgery. Of moderate price, soluble in all proportions with water, alcohol and glycerine, having but a very weak toxicity, neither altering instruments nor discoloring the hands, it is simple and advantageous in use. The strong solution (3 to 5 per cent) is employed for disinfection of the operative field, the hands, instruments, and the treatment of infected wounds. The weak solution (1 per cent) may be used on bleeding wounds and mucous membranes; it is extensively used in obstetrical operations, and for the disinfection of the uterus. Cresyl is not good to use in the preparation for dipping the instruments during operations; it renders them slippery and the white mixture it makes prevents their being distinguished and taken out with ease.

Here are the two most generally used formulas:

Cresylated alcohol.

Cresyl	1 gramme
Alcohol (90°)	10 grammes

Cresylated vaseline.

Cresyl	1 gramme
Vaseline	10 grammes

Trichloride of Iodine is an antiseptic almost as active as corrosive

sublimate (Langenbuch, Kitasato). It can be used to disinfect the hands, the operative field, the instruments, and the material for dressings.

Pure *tincture of iodine* may take the place of strong antiseptic solutions for the disinfection of suppurative wounds.

Chloral, in solution of 1 per cent, is only used for antisepsis of the mouth or of the rectum.

Nitrate of silver, in strong (1 in 50–100) or weak solution (1 in 1000), is used successfully to obtain the disinfection of some inflamed mucous membranes.

Boric acid, in concentrated solution (3–4 in 100) is far from possessing the antiseptic properties attributed to it by Lister. About five times less active than phenic acid and a hundred times less than corrosive sublimate, it is used only in the antisepsis of the mucous membranes (eye, nasal and buccal cavities, ear, rectum, vagina and bladder).

Naphthol, in solution 1 in 1000, is also a weak antiseptic.

Naphthaline, which has the same properties as naphthol, exerts an irritating action upon the tissues, and stimulates the granulation of wounds.

Camphorated naphthol is a light yellow or brownish yellow syrupy product, prepared by triturating one part of naphthol with two of camphor. *Camphorated salol*, a whitish liquid, is obtained by warming together equal parts of salol and pulverized camphor. *Camphorated thymol*, an almost limpid liquid, is prepared by triturating one part of thymol with two of camphor. These three products are utilized in the treatment of suppurating wounds.

Boiled salt water (6 or 7 grammes of salt to each litre of water) is excellent for peritoneal irrigation in operations made on the abdominal cavity (Kocher, Tavel).

We must also mention *thymol*, *lysol*, *solutol*, *salveol*, *dermatol*, *chloral*, *chlorine water*, *sanitas*, several *essences*, *microcidine*, *alcohol*, *tannic acid*, *salicylic acid*, and *sub-nitrate of bismuth*. These last three are used in thin layers, or blown upon the wounds.

The number of antiseptics is increasing every day, but the latest offer no real superiority over those used in the beginning. Carbolic acid, corrosive sublimate, chloride of zinc, and iodoform, equal all the others.

INSTRUMENTS—DRESSING MATERIAL.

Instruments entirely of metal, without useless grooving, and as simple as possible, are used in preference to all others. Complicated instruments, or those invented for the execution of special operations, are more useful in the show cases of the instrument

makers, or of colleges and museums. Veterinarians must accustom themselves to do without them; they are, however, only useful for unskilful surgeons. Every practitioner knows that with a simple probe-pointed bistoury the neck of the vaginal sheath is more easily divided than with any of the herniotomy knives. One of us has shown that the complicated establishment, built thirty years ago for the ovariotomy of large domestic females, is no longer of other than historical interest. The Chassaignac, well made and well handled, is better than any of the improved ecraseurs. To these we could add many other examples.

In rural practice a decorated surgical outfit would be a useless luxury.

The material for dressings consists of wadding, oakum, silk, Florence hair, horse hair, Breton thread, sponges, compresses, gauze, bandages, and coarse nettings.

Wadding is an excellent material, not irritating to the tissues; it possesses remarkable absorbing properties. It is rather costly. For large animals one can make with it the first layer of dressing for serious wounds occasioned either by operations or by severe accidents; it is used in large quantities only for small subjects and expensive animals. *Peat wadding* (*ouate de tourbe*), readily absorbing, supple, elastic, cheap (cheaper than oakum), is very good for all cases. *Wood wadding*, used by Möller at Berlin, has the same qualities. *Oakum* is found everywhere, but is inferior to the preceding. *Gauze*, a good absorbent, and not irritating to wounds, is, like wadding, too expensive for animals; it is used only for severe traumatisms and costly animals. Most sutures are made with *silk* or *thread*; *hair* and *catgut* are less used. Ordinary silk, flat or braided, the last preferably, are generally employed. They are of various sizes. To envelope the surface operated upon, compresses are made of coarse netting, gauze or old linen; to dry the wounds, small compresses are preferable to sponges. Dressings are secured with ordinary bands, or, more economically, with coarse netting made into bandages 6 or 8 centimeters wide.

TECHNIC OF ANTISEPSY AND ASEPSY.

Let us now consider what antiseptics, in general practice, are to be used preferably for the disinfection of the hands (surgeons and assistants), of the instruments and objects of dressing, and of the operative field, and how they are to be applied.

Disinfection of the Hands.—The experiments of Fürbringer on this subject have shown that asepsis of the hands is not easily realized. It is, however, of importance, because, as said by Lefort thirty years ago, very often the hand is the agent of the infection of operative wounds. The surgeon who does not wish to meet with trouble

must have his hands perfectly clean. The nails, the sub-ungual spaces, chaps, wrinkles, and the pores of the skin are true "microbic dens," and to destroy all of these microbes, the greatest care is necessary. There are even cases where, no matter what is done, hands cannot be rendered completely aseptic. Kümmel, Fürbringer, and Terrillon have observed that when they have been soiled with pus, putrid or septic liquids (interference with injected wounds, post-mortem), it is impossible to render them absolutely sterile for forty-eight hours. This is a fact that surgeons must bear in mind, when they are about to operate upon the abdomen (laparotomy, cryptorchidy, ovariotomy); it imposes, when possible, the postponement of an operation for several days, and also greater care when the case does not permit of postponement; and it explains perfectly the failures which sometimes occur when one thinks he has followed all the rules and should have been successful.

The toilet of the hands begins with the mechanical cleaning of nails, dry, and cut short; then the hands and forearms should be washed with soap and warm boiled water, and rubbed with a brush or a coarse towel; they should be washed a second time with alcohol at 80°, then a third time with a solution of corrosive sublimate of 1-1000. Alcohol is very advantageous to dissolve the greasy substances which interfere with the effect of the antiseptic bath.

More complex procedures have been recommended, but this one is sufficient; and in our surgery most commonly the care of the nails, and the washing with soap and boiled water, followed by one with a corrosive sublimate solution 1 to 1000, or cresyl 3 p.c., are all that is done. The hands must remain free from all dirt during the whole operation, "aseptic they must be, aseptic they must remain." One should be careful not to touch with them the skin of the surrounding parts, nor the table upon which the animal lies, nor the straw,—in fact, any object not disinfected. Even when no suspicious substance has been touched, it is proper, during the operation, to dip the hands now and then in the Van Swieten solution; and whenever they have lost their "antiseptic virginity," the whole process of cleaning must be done over again (Forgue and Reclus). This has to be done often during operations performed upon animals; and this rule must be severely followed, especially when manipulations are made about the peritoneal cavity. In those cases, a simple oversight of this kind may be the cause of the death of the patient.

Covered with a blouse or with an apron, the operator should have the shirt sleeves rolled up. It is wise for those who perform delicate operations, and who wish to obtain adhesive cicatrization, to keep their beards and hair short; all rings and jewels would better be removed, so that the hands may be perfectly free when working on the abdomen.

Disinfection of Instruments. — The handles of instruments should be plated with nickel or aluminium. (Fig. 29.) Rough surfaces, grooved jaws, joints of forceps, the ends of grooved probes, and the eyes of needles should be carefully looked after. Complicated instruments, and those difficult to clean, should be avoided. For sutures, the needles of Larger or of Lamblin (figs. 30, 31, 32) are preferable to all others ; they are simple and of easy aseptisation. Instead of syringes for injections, glass funnels with disinfected India rubber tubes are preferable. A number of ways and of agents have been

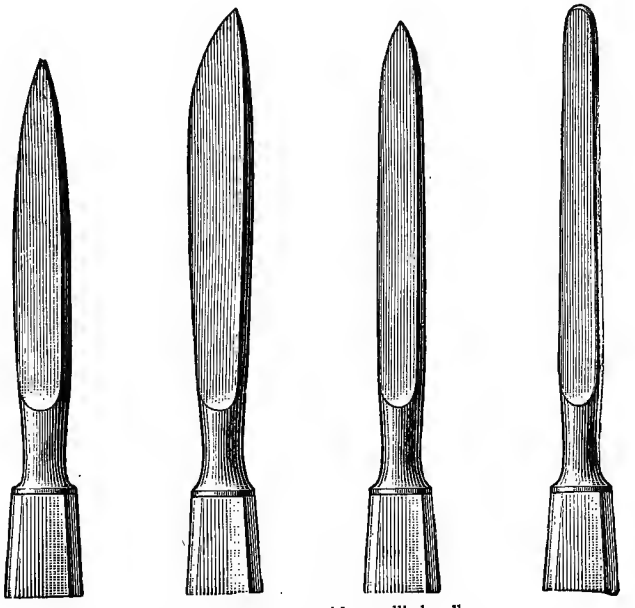


Fig. 29.—Bistouries with metallic handles.

recommended to render instruments aseptic. Soaking in a strong phenic or cresylic solution is a method used by some ; but phenic acid dulls the edges of the bistouries, and cresylic makes them greasy and slippery, and the opacity of the emulsion prevents their being seen through the vase where they are deposited. Immersion in boiling water is simple and practical. The degree of ebullition of the water can be raised by adding common salt, or carbonate of soda, (Bergmann, Schimmelbusch), or carbonate of potash (Terrier), or chloride of calcium (Redard). Alteration of the instruments is prevented by adding to the water 1 per cent. of caustic soda. Baths of oil, glycerine, or liquid vaseline, at a temperature of 120° to 130°, produce a complete disinfection. When instruments are soiled by some virulent matter, such as proceeds from a septic or tetanic center, the best way to render them aseptic is to dip them for 10 or 15 minutes in a

bath of oil or of glycerine. Except in such cases, boiling in ordinary water or in a solution of carbonate of soda (104°) is sufficient. Instruments with wooden handles are spoiled by boiling; with them, a careful cleaning of the handle is necessary; the blade alone is dis-

Fig. 30.

Reverdin's needle.

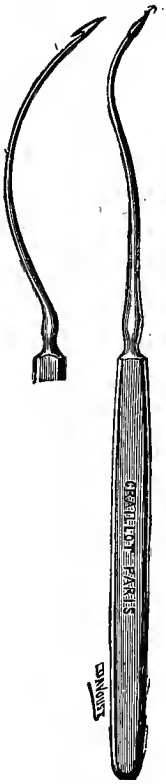


Fig. 31.

Larger's needle.

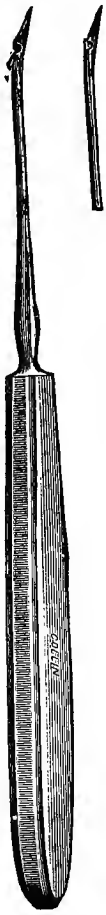


Fig. 32.

Lamblin's needle.

infected in boiling water. The autoclave, and damp or dry ovens are the apparatus of the laboratory, or for surgery in hospitals. Passing through the flame of an alcoholic lamp, Tédenat's "punch for instruments" is also a rapid way of disinfecting them. The instruments are placed on a metallic plate, and some alcohol is poured over them and lighted; a few minutes are sufficient for their sterilization. They are then placed in a weak antiseptic solution or in boiled water. Although this process is excellent for ecraseurs, forceps

and probes, it has the objection that it softens the edges of the bistouries, sage knives and scissors. Gum probes should be cleaned with alcohol at 70°, and then in a corrosive sublimate solution of 1 to 1,000.

Besides instruments, there are sponges, balls of cotton, of oakum, compresses, threads and other objects of dressing used by the surgeon. All this surgical material must have received a special preparation — it must be aseptic. This is the way to do it:

Sponges are cleaned under running water after being freed of their dirt by hammering them with a mallet; they are then placed for 10 or 12 hours in a solution of permanganate of potash 1 to 1,000, are well washed with sterilized water, and are placed in a strong phenicated solution, where they remain a month or six weeks before being used. Then they are washed with boiled water, to remove the excess of phenic acid soaked into them.

To-day sponges are generally discarded: they are replaced by *compresses* of *gauze* and the *sponge-tissue* sterilized in the autoclave, or by *balls* of hydrophilous *wadding* or *peat wadding*, also sterilized. Many veterinarians are still using *oakum;* it is good only when free from the hard substances it contains, and sterilized by heat or immersion in an antiseptic solution heated to 100°. Generally it is only soaked for five minutes in boiling water or in a solution of soda. Eloire uses the dry heat of an ordinary oven (oven for roasting) that is found in almost all houses; the oven is filled with oakum, which is heated and removed when it begins to burn.

Sterilization of *silk thread* is made by immersion for half an hour in boiling water or by keeping in the autoclave at 105° to 110°. Immersion for fifteen minutes in a strong phenic solution is sufficient. It is kept in phenic acid solution at 5 to 100, or in corrosive sublimate 1 to 1,000.

After removing the grease of catgut with ether, the threads are left to dry, rolled afterwards on spools, sterilized in *dry* heat, and preserved in a strong antiseptic solution of phenic acid or corrosive sublimate, or in boiled olive oil.

Silk-worm gut, also freed from grease with ether, is left for half an hour in boiling water and kept in glass tubes filled with a corrosive sublimate solution 2 to 1,000.

Paraffined thread is prepared by dipping into melted paraffin linen thread which has been soaked in ether or spirits of turpentine (Pecus). Since it is a little rough when it has cooled, it is made smooth by polishing with a fine cloth. This thread is supple, does not absorb organic liquids, and cuts the tissues but little. It is especially useful for sutures which are to remain long in position.

Red rubber *drain tubes* are preferable to all others. After being washed in a concentrated solution of permanganate of potash, they

are left for 20 minutes in boiling water, and then placed in glass tubes containing a corrosive sublimated solution 2 to 1,000, and sterilized by exposure to a temperature of 120° for half an hour.

These manipulations, prescribed for the sterilization of compresses, threads and drains, are not strictly necessary. Immersion for 5 or 10 minutes in a phenic, cresylic or strong corrosive sublimate solution, carried to ebullition, is the common practice in veterinary surgery. It is considered sufficient (Bang).

The *operative field* and its surroundings must be carefully purified. In all animals, the skin, even in a state of perfect cleanliness, is occupied on its surface by numerous micro-organisms of very many kinds, among which the staphylococci (staphylococcus albus and aureus) are especially abundant. It is, therefore, always indispensable to proceed to the disinfection of the region to be operated upon. If the skin is sound, the hair should be cut with scissors and the tegument soaped, shaved, brushed and washed with boiled water. After having been dried with sterilized compresses, friction with alcohol or ether should be made to remove the greasy substances on its surface. This is completed by a last washing with a strong phenic acid solution or corrosive sublimate 1 to 1,000. If the skin is infected, if the region is the seat of an ulcer, suppurating traumatism or a fistula, one must, the day before the operation, or several days before, scrape the wound with the curette, and then proceed as indicated. These two methods are not applicable to all surfaces. They must be modified for certain regions; for the mouth, the nose, the ear, vagina, uterus, bladder, rectum and the foot. The surgery of those regions requires a special technic. In the case of all mucous membranes, in order to permit the more complete action of antiseptic solutions, a free washing with boiled water should be made, to remove the mucus deposited on their surface.

The *mouth* is a cavity always inhabited by micro-organisms, and its disinfection is difficult. In large animals, free washings with water, and cleansing with solutions of boric acid (2 to 4 per cent.), of permanganate of potash (1 per cent.), are sufficient. In the case of dogs, loose teeth and diseased roots should be extracted. Gums are to be touched with a tincture of iodine or solution of creosote.

Intestinal antisepsis, employed in cases where the intestines are to be the seat of the operation, or when manipulations are to be made in the peritoneal cavity (laparotomy, ovariotomy, cryptorchidy), demands the following precautions: purgation, low diet or milk diet, and administration of antiseptic agents. Saline purgatives given in small doses for several days do well to prepare the asepsis of the intestines; afterwards, naphthol, betol, or creolin (50 centigrammes to 1 gramme for small animals, 5 to 10 grammes for horses and cattle). Enemas of solutions of permanganate of potash (1 per cent.), of

cresol (1 to 2 per cent.), corrosive sublimate (1 to 200), or of boric acid (4 per cent.), complete the antisepsis previous to the operation. During intestinal diæresis, the parts taken out of the abdomen should be spread upon warm sterilized compresses; the peritoneum should be kept free from any matter that may escape from the incision; the intestines should not be returned to the abdomen without perfect closing of the wound, and not until after the serous membrane, round the stitched parts, has been touched with a strong phenic acid solution, so as to give rise to slight adhesive inflammation. After the operation, for eight or ten days, the patient should receive only liquid food in small quantities (milk and bouillon for small animals, milk and hay tea for the others); the animal should receive its ordinary rations by degrees.

Rectal asepsis.—For this a low diet should be taken for several days, and the same agents as those used for intestinal asepsis should be employed, especially the rectal irrigations. Disinfection of the anus is accomplished as in the case of the healthy, sound skin.

Nasal cavities are rendered aseptic by washes and with sterilized tepid water, followed by solutions of corrosive sublimate, 1 to 5,000, or of permanganate of potash, 1 to 1,000.

The *eye* is an organ requiring delicate asepsis. It may be washed with sterilized water, a boric solution, 4 per cent., cresol, 1 to 150-200, or the following, recommended by Panas, for man:

Bi-iodide of mercury	5 to 10 centigrammes.
Absolute alcohol	20 grammes.
Boiled filtered water	1,000 grammes.

Corrosive sublimate must be used only in very weak solutions (1 to 5,000). Instruments must be sterilized, especially if the operation is to be on the eyeball itself.

The disinfection of the *auditory canal* is made with weak antiseptic solutions. The skin is cleansed with tepid water and soap; after it is well dried, injections are made of boric acid (3 to 4 per cent.), of permanganate of potash (1 to 1,000), or corrosive sublimate (1 to 5,000). If the secretion is abundant, it is advantageous to use powders of bismuth, iodoform, salol, or dermatol.

Antisepsis of the vagina is easy in most cases. First a soap washing of the mucous is made; then it is thoroughly irrigated with a boric (4 per cent.), cresyl (2 per cent.), or corrosive sublimate solution (1 to 2,000). These irrigations are repeated for several days. Instead of a syringe, it is better to use an irrigator like that recommended for women by Tarnier, consisting of a glass reservoir with an India rubber tube, the extremity of which is introduced into the vagina. Vaginal disinfection is difficult when the mucous membrane is the seat of polypuses, ulcerated tumors, and in cases where it has been contaminated by the putrified afterbirth.

Asepsis of the *uterus* demands the same measures as that of the vagina. With an India rubber tube, the uterine cavity is washed with tepid irrigations of a harmless antiseptic solution (boric acid or cresol). Corrosive sublimate (1 to 3,000), or bi-iodide of mercury (1 to 20,000) can be used.

With the exception of catheterism, but few operations are performed upon the *bladder*. In this case what is important is prophylactic asepsis. The dangers likely to follow urethral catheterism, as practised to-day, have been hitherto entirely overlooked. Acute cystitis and its numerous complications may be the consequence of the introduction into the bladder of dirty catheters, which are never cleaned, and are, therefore, more or less septic. Urethral probes should be disinfected by a long immersion in a strong antiseptic solution, and should be kept in special cases.

In *operations on the foot*, local antisepsis may be obtained as follows : The shoe having been taken off, the plantar surface is thoroughly cleansed, the hair is cut short upon the entire phalangeal region, the hoof and the skin are thoroughly washed with soap and warm water, then with an antiseptic solution, in which they are soaked for fifteen or twenty minutes, and finally the feet are covered with moist antiseptic compresses, wrapped in a cloth and secured by bands of gauze. A cataplasm of linseed softens the hoof and may be useful, providing it is prepared with a somewhat concentrated antiseptic solution ; but for asepsis, compresses are undoubtedly better. (Benjamin.)

Before beginning the operation the threads for ligatures and for the sutures and the dressing materials should be placed in one bowl or on a plate, while in others, containing the antiseptic solution, should be kept the instruments with absorbing cotton to take up the blood.

As soon as the skin is cut the blood oozes out, and its flow increases as the cut is increased ; the field of operation is covered with it. As long as the hemorrhage takes place, extending through the small blood vessels, the blood should be taken up by the wadding of cotton balls, which are taken out of the antiseptic solution as they are needed. Irrigations with a strong phenic acid solution stimulate hemostasis, the tissues shrink, the vascular openings contract ; but these irrigations have the objection of producing a superficial necrosis. Unless infection exists, simple boiled or slightly salted water is sufficient. When small arteries, or veins of some size, are cut through, they are closed with the forceps or ligated with silk or catgut. In most inflamed tissues an abundant hemorrhage follows, even if there are no large blood vessels. In these cases thermocautery is advantageous ; the blade, heated red hot and passed over the edge of the wound, is sufficient to stop the hemorrhage. The scab formed is very thin and aseptic, and does not interfere with cicatriza-

tion by first intention ; in fact, it may be entirely absorbed. Such is the case also of ligatures left in the wounds ; they are digested by the tissues, destroyed in a few days by the migratory cells and by newly formed elements (catgut), or are encysted and slowly absorbed (silk).

If immediate reunion be looked for, every care necessary to prevent the wound from being contaminated should be resorted to. Perfect hemostasis and an exact closing of the wound are two essential conditions. A thin bloody aseptic layer, interposed between the edges, does not prevent primitive union ; tissues support it and in fact utilize it for the process of repair ; but large clots are absorbed with difficulty and form a ground most favorable to the multiplication of pyogenic microbes. Raw surfaces, dried as completely as possible, and covered with antiseptic vaseline (vaseline 50, pulverized boric acid 5, iodoform 1), are to be brought close together throughout their whole extent, in their superficial and their deep part; the contact must be *uniform* and *entire*. When the contact does not exist in the depth of the wound, a dead space is left, where the blood and the serosity gather, an "antiplastic" center, where the germs which may remain in it will rapidly multiply. In cases where the wound involves several layers of tissues, it is necessary, in order to keep them close together, to add to the silk or silk-worm gut stitches on the surface, some catgut or silk sutures lower down, held at their extremities by small rolls of gauze (quilled suture). Washing the suture with corrosive sublimate, drying it with wadding, and covering it with iodoform collodion or a cotton dressing, completes the operation.

In wounds, where the perfect adaptation of the edges is not possible, or in traumatism with loss of substance, one must provide for the escape of the secretions of the wound by drainage obtained either with one or with several rubber tubes (tubular drainage), or with disinfected horse hair or silk-worm gut (capillary drainage), or again with gauze (draining tent). Rubber drain tubes are mostly used. They are secured to the lips of the wounds with thread, silk, or hair. They allow antiseptic injection without interfering with the sutures.

Such are the measures required by asepsis and antisepsis, in order to give subjects operated upon, as nearly as can be, absolute protection against infection. And many are the superfluous details which we have omitted.

In most hospitals for human patients, a perfect appliance of special apparatus for disinfection, and of numberless precautions, insure, for a certainty, the success of the operation ; the surgeon can always obtain, when he wants it, reunion by first intention, and render harmless the long manipulations he has to make in the abdominal

cavity. Almost all the Veterinary Schools of Europe and of the New World have also rooms for operations, provided with appliances and material which make easy the practice of asepsis and antisepsis: such as the Daviau and Vinsot apparatus,—mattress for casting large animals; special tables with metallic cover for other animals, the Chamberland autoclave, drying ovens, fixed and movable reservoirs for antiseptic mixtures, etc.

Fortunately, it is not necessary to follow strictly this technic, in order to have, in the case of all kinds of animals, long lists of successful operations, without excepting those that are performed on the abdomen. Even in the case of man, when the operation is to be made outside of the hospitals, the surgeon, with less complicated means, knows how to realize a sufficient antisepsis and obtain an "almost complete immunity."

Our colleagues, who have given lists of 100 castrations on cryptorchids, without a single failure, have certainly not complied with all these rules of antisepsis. Although these are very important, when one operates in an infected center, in the atmosphere of an hospital, with instruments "to do everything" (*à tout faire*), they may be partly neglected for operations performed under more favorable circumstances, either in cities or in the country. Without such abundance of instruments, of vases, antiseptic agents and materials for dressings, conditions of asepsis can be realized, sufficient to insure satisfactory results in operation. There are, besides, circumstances in which a surgical interference must be immediate, in which the patient cannot be saved except by an operation made immediately, and that, too, with whatever means one may have at his command.

In such cases, let us see how to proceed: The operation should be performed under a shed or in the open air, without neglecting to utilize the "sterilizing action of the sun." One should see that dust raised by the struggles of the animal be not permitted to accumulate in large quantities over the field of operation; to do this a light sprinkling of the bed is an excellent precaution (Möller.) Two large basins should be used to prepare a solution of common salt (6 to 7 per cent) in boiled water. The region to be operated upon, clipped or shaved, should be well scrubbed with soap or with a rough towel, then washed with the salted water. After cleaning his nails, the surgeon should wash his hands and forearms with the same solution and soap. An earthen bowl passed through the flame of the alcohol lamp should be used for the ablutions during the operation.

The instruments should be disinfected by passing them through the flame of an alcohol lamp, or a wax candle, or that of a straw fire, etc., or by dipping them for 5 or 10 minutes in a boiling solution of carbonate of soda (1 per cent.) Boiling salt water will be used to disinfect the towels, threads, oakum, etc.

The wound to be operated upon must be protected by a *dressing*. It should be covered with layers of wadding or oakum, arranged as the case demands, and secured with bands. For operations upon the foot, the general wrapping that we have been using for about 10 years is far superior to the ancient "pads" supported by pathological shoes made *ad hoc*.

Dressings applied to the superior regions of the extremities should be moderately tight, or cover the entire part situated below the seat of the lesion, so as to avoid gangrene and the arrest of the circulation.

The first dressing is very important; often it decides the progress of the wound. It should be left in position a variable length of time. If the general condition of the patient is good, the traumatic fever moderate, the hyperthermia little marked; and if, besides, the dressing remains dry, it should not be renewed under 12 or 15 days in winter, 8 to 10 in summer. The band or gauze should be taken off and then the superficial layers of wadding in succession; if under these the others adhere to the skin, they should be softened or detached with a tepid antiseptic liquid. If it be a foot dressing, the whole should then be soaked in a pail and the skin should be carefully cleansed with wadding or cotton.

In the cases where immediate union has been obtained, in general, the wound is cicatrized when the first dressing is removed; if it only be in good condition, a second dressing is put on with the same attentions as for the first. Mechanical interferences and stretchings of the edges should be avoided; if one or several drains are in the wound, they should be replaced after having been disinfected, or should be changed for others smaller. When the wound suppurates, the sutures should be cut, the drains taken out and free antiseptic irrigation should be made; and to avoid injuries to the granulating surface and inoculations of a post-operative nature, at times a new dressing, with or without drainage, is applied; at others the wound is left uncovered, protected only by antiseptic liquids and powders; the latter absorb the secretions of the wounded surface, prevent the pullulation of germs and diminish the absorption of toxic products.

Various modes of treatment present themselves when local complications (abcesses, undermining, phlebitis, lymphangitis, necrosis, caries) have occurred. This is not the place to consider them. Let us say, however, that continued bathing in warm antiseptic solutions acts marvelously with the infected wounds of extremities, and that atomizing with the same solution is excellent for disinfecting anfractuous parts of the regions where bathing is not possible. With wounds of a bad nature, exposed necrosis, or fistulæ, one may utilize with advantage the steam atomizer of Championnière (fig. 33).

Generally, in veterinary medicine, antisepsis must be simple and not costly; but no matter what the expense may be, it must be

carried out in penetrating wounds of the thorax, of the abdomen, articulations, tendinous sheaths, tendinous lesions, or of the cartilages or bones. What we must expect of it is to protect our patients, wounded or operated upon, against serious infectious complications of wounds; but the unfavorable conditions under which we ordinarily perform the operations, and the restlessness of most animals, render uncertain the cicatrization by first intention of wounds of operations.

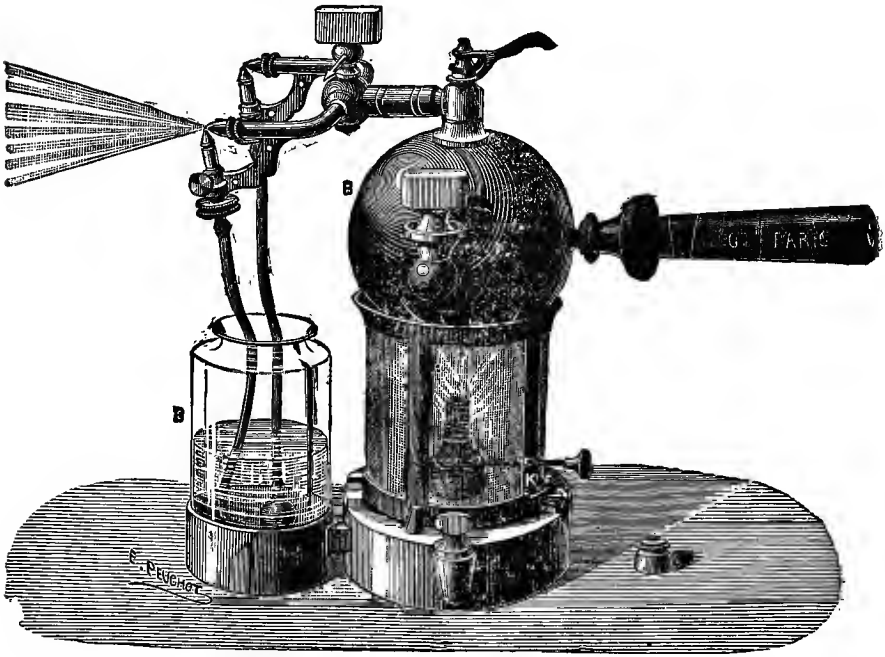


Fig. 33.—Lucas—Championniere's atomizer.—*B*, boiler; *H*, spirit lamp; *D*, vase containing the antiseptic liquid.

And although it be not necessary to make use of asepsis and antisepsis as strictly in the country as in hospital centers, wherever one uses the bistoury they must not be entirely ignored, as in such cases the omission would be the more blameworthy the better the serious possible consequences are known. Everywhere to-day, as in days gone by, when we commit that error, the small incision in the skin is a door open to infection and to death. If we cannot comply with all the exigencies of antisepsis, at least we must observe its great rules—operate with cleanliness, and do not injure the patients. That is the first precept of the art: *Primo non nocere.*

IV.

HEMOSTASIS.

To reduce to the minimum the hemorrhage that takes place during an operation, and to guard against that which may follow, are important rules of general surgery. The red sheet formed by the blood flowing from the small divided tissues veils them and also the organs that the instrument must spare; and although it obliges the operator to stop his work frequently, it has no serious consequences. On the contrary, arterial or venous hemorrhages may produce abundant waste of blood; if they occur secondarily and are not promptly averted, often they are followed by death. They must be prevented or attended to in order to stop them definitively. Perfect hemostasis is peculiarly important in the operations upon the abdominal organs; if blood escapes in a great quantity in the peritoneal cavity, the inflammation of the serous membrane is a complication seriously to be looked for. And, generally, when blood accumulates on wounds after the closing of their edges or the application of a dressing, suppuration takes place, and the production of general disorders of an infectious nature is greatly assisted.

I. *Preventive or Pre-operatory Hemostasis.*—It is used principally for operations upon the extremities. In the case of animals, digital pressure, tourniquets, or compressors are seldom employed. Ligatures and the Esmarch process are the usual expedients.

For horses, ordinarily, circular and total constriction of a leg is made with a loop of cord, placed round the fetlock or the coronet, and is twisted several times round the parts or submitted to a torsion made with a piece of wood acting as a tourniquet. The strong pressure made upon the vessels, where the cord is applied, cuts off the circulation, and the hemorrhage soon stops. This ligature has another effect besides. The conductibility of the compressed nerves is less free, the sensibility of the regions situated below the ligature is diminished, and the pain of the operation is thus much reduced.

Striction with an India-rubber tube or band is less primitive and less brutal. Take a strong tube, 50 or 60 centimeters long, stretch it in rolling it round the leg above the knee or the hock, tie both ends together or secure them with a strong thread (fig. 34). Hemostatic India-rubber bands and tubes are made with a metallic hook and eye, by which they can be well secured in making the proper compression.

The method of Esmarch is advantageous, when, having to amputate a leg (small animals), or to excise organs highly hyperæmic (prolapsed uterus), one wishes to operate on dry tissues. The in-

ventor made it known in 1873, under the name of *artificial ischæmia*. It consists in the use of an elastic band (plain or covered rubber), which is rolled round the leg or the mass to be removed, beginning at its free end. The spirals of the band, touching or partly covering each other, must exercise upon the tissues a strong pressure, which pushes back by degrees the blood towards the trunk.

When the blood has been pushed out of the parts which are to be excised, a strong India-rubber cord is tied below the band. which,

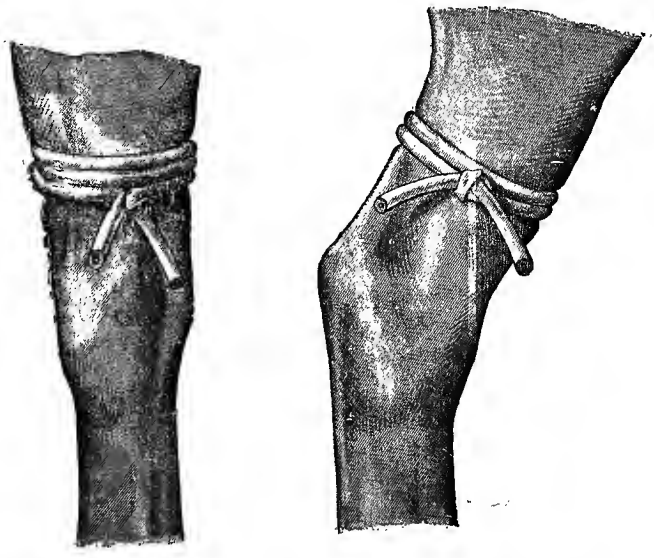


Fig. 34.—Preventive hemostasia. Rubber ties applied above the knee and the hock.

pressing upon the arteries, closes them, and, therefore, acts as a garrot. The band is then removed and the operation is performed below the cord without blood. In this process, two hemostatic means are used: the artificial ischæmia, obtained by the centripetal pushing of the blood, which is thus kept in for the organism; and the striction, which keeps the tissues bloodless by preventing the flowing of the arterial blood, and thus insures a bloodless operation. When the part which is to be submitted to *Esmarchization* is the seat of a wound, more or less extensive, this must be covered with a coat of wadding or a compress, which is placed under the band.

When the operation is terminated, the blood-vessels are ligated and the constricting rubber cord removed. Often then, if the stump has not been cauterized, through the small arterioles and numerous divided capillaries, an abundant hemorrhage spreads over it, which is due to a vasomotor paralysis, the effect of the prolonged com-

pression. This hemorrhage is arrested with cauterization, cold irrigations, phenicated lotion, or by a compressive dressing.

In general practice, the Esmarch method is not rigorously applied, Often only the circular constriction is used. Generally speaking, it is better to use it when the tissues are seriously injured or infiltrated with pus or infectious liquids, which, crushed in by the compressors, might give rise to serious accidents; but as the hemorrhage is sometimes very abundant on account of the venous stasis, it may be reduced by the application of a second constricting cord to the other end of the region to be operated upon.

Mediate compression, with the fingers, of the principal arterial trunk, which distributes blood to the parts to be operated upon, is seldom used; if it is employed, it must be kept up until complete hemostasis is definitely obtained. During the operation it can be suspended in cases where the ends of the divided arterioles are hard to find; small spurts of blood then indicate their location. When the garrot has been used, it is sometimes useful for the same reason to diminish the constriction.

A strict diet for twenty-four hours before an operation is also a means of reducing the hemorrhage during bloody operations.

II. *Hemostasis During and After the Operation.*—Most of the processes mentioned above are only applicable to a limited number of regions; and often, during the progress of an operation, the blood flows freely from numerous small divided blood-vessels, veins or arterioles.

There is only a slight hemorrhage, or none at all, when one has recourse to the processes for bloodless exæresis: actual cauterization, thermo-cautery, galvano-cautery, caustics, linear crushing, tearing, elastic ligature, etc.

As an excellent means of hemostatic diæresis, *actual cautery* is, also, often used to make punctures or remove tumors. It has been abandoned for the destruction of neoplasms, since it seldom gave good results: under the scar produced by the cauterization, the irritated tumor would grow again. The red-hot iron, worked like *a bistoury*, is still used to make some excisions. When carried to white heat, it cuts the blood vessels too rapidly, and their obliteration is then incomplete; if it is only dark red it cuts them, at the same time stimulating the retraction of the coats of the vessels; so that this heat is the proper one to obtain good hemostasis. Introduced into the tissues, the actual cautery soon cools off; and its repeated application is necessary to divide a layer of tissue or excise a tumor. On that account, the thermo or galvano-cautery are better instruments; with the zoocautery one can make punctures, deep incisions, and excisions, without hemorrhage.

The *écraseur* of *Chassaignac*, almost unused now by surgeons for

mankind, is of frequent use in veterinary practice. It squeezes, crushes, and divides soft tissues, somewhat like a saw. Mucous membranes, connective tissues, muscles, blood vessels, fibrous layers, and neoplasms give way to the progressive striction of the écraseur, and are cut without hemorrhage, if the instrument is worked with the proper slowness. Its action is principally remarkable upon blood vessels: the middle and internal coats of the arteries are ruptured and retract upon themselves, while the external coat stretches and closes the open mouth of the vessel. Too rapidly made, the division does not prevent hemorrhage; but if one acts slowly, if the cutting of the tissues is made by gradual shortening of the chain, every 30 or 50 seconds of time, according to the degree of vascularity, there is scarcely any flow of blood. The pain, which is very great when the tissues are strongly compressed, subsides as soon as the division begins. In general, the wound of such cutting cicatrizes a little more slowly than that made with the bistoury: the anatomic elements of the superficial layer undergo a process of necrosis.

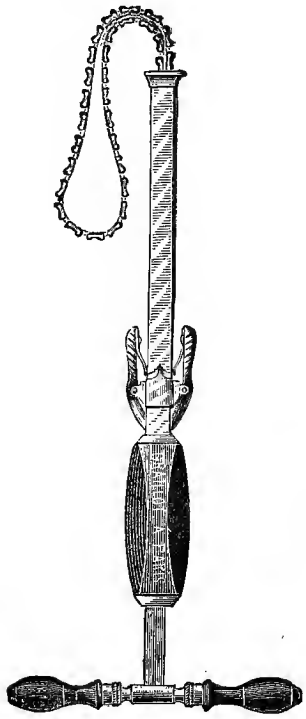


Fig. 35.—Chassaignac's ecraseur.

The process of *tearing* is principally used in the removal of tumors well defined, with little adhesion to the surrounding tissues. The skin being incised, the neoplasm is isolated either by digital pressures or tractions made with the hands, which separate the parts in tearing the connective tissue; or by giving to the neoplasm movements of traction and of torsion; or by combination of the two modes. Although *tearing* is advantageous in this, that it permits of saving the principal blood vessels and nerves, it is generally very painful in regions rich in nerve ramifications; it does not allow the complete removal of invading neoplasms, extending to the lymphatics, and leaves "roots for new growths," which give rise to secondary tumors.

Dull dissection, the enucleation of Percy, is made with the dull end of a directory or spatula. The directory is generally used, with which the connective tissue is torn and isolated without danger of

hemorrhage. This is an excellent process when one has to operat in regions of dangerous structure. It is especially used to isolat blood vessels (ligature of the jugular) and nerves (neurotomies) Wounds made by tearing and by enucleation behave as those mad with the bistoury ; they cicatrize nearly as easily and as quickly a clean-cut sections.

Scraping is made by removal with the drawing knife or the shar curette. It permits the excision, with little hemorrhage, of the granulations and fungosities which line fistulous tracts and walls o suppurating cavities, and the scraping of carious bones.

The various modes of *ligature* are frequently employed to obtain the mortification and elimination of tumors, and of organs, in part or *in toto* (vagina, uterus). The best of these is the elastic ligature.

But these means of exæresis are useful only in a limited number of cases. It is the bistoury which is generally used ; and often it divides tissues in which preventive hemostasis could not have been realized. Then the blood flows, in a stream or by spurts, as the instrument divides small blood vessels or arterioles.

Capillary hemorrhages ordinarily stop spontaneously ; the very small vessels are depressed by the retraction of the tissues, and their microscopic mouths are soon obliterated. If the hemorrhages continue in streams, they can be arrested by affusion of cold boiled water, made with aseptic sponges or compresses, held up above the wound, and gradually squeezed. More active are the lotions with solution of alcohol, phenic acid or corrosive sublimate, which produce a peculiar "pickling" of the living surfaces, coagulate the liquids, and, in general, rapidly correct capillary exudations. A strong phenic acid solution is the most advantageous. Not to be disturbed by these flows of blood, one must be careful to have prepared lots of little balls of cotton which have been dipped in an antiseptic solution. An assistant using these successively, after having squeezed them to rid them of the solution, should soak up the blood, dry the surfaces, and thus allow the surgeon to see clearly the parts upon which he is operating. Among the hemostatics of old surgery now out of fashion we may mention : snow, ice, ether, chloroform, alum, metallic sulphates, perchloride of iron, nitrate of silver, vinegar, Rabel solution, the numerous "hemostatic washes," the absorbing powders,—flour, ashes, agarics, amadou, and the dangerous spider web.

When arterioles, small veins or canals of larger caliber are divided, one can arrest the blood by using *compression* or *plugging*, *cauterization*, *ligature*, *torsion*, or "*forcipressure.*"

Compression is useful in cases where one has no time to look for the end of the cut vessel. It is performed, as aforesaid, in the neighborhood of wounds or upon one of its lips, by pressing with

the finger or a ball of cotton the part where the blood vessel is situated. It is rarely sufficient to produce definitive hemostasis. When the operation is ended, other hemostatic means must be used.

Cauterization of raw surfaces and of vascular stumps is hemostatic only by making a more or less thick scab, great inflammation, and abundant suppuration.

Ligating of Blood Vessels is made with silk threads or catgut. In excisions, when a visible and isolated artery has to be divided; two ligatures are applied upon it, between which the cut is made. If the blood vessel—artery or vein—is divided by accident, the ends are secured with forceps or a tenaculum and tied up with a straight knot. Constriction made upon an artery has the effect of dividing its middle and internal coats, which, curving inwards in retracting, close its mouth. The external wall shrinks, rests upon itself, and does not give way for several days later. When catgut is used, the ends of the ligature can be cut close to the knot; with silk thread only one of the ends is cut close to it, the other is brought outside of the wound, to be pulled away with the rest of the thread when the division of the blood vessel is complete. Hemostatic forceps with broad jaws, conical or cylindro-conical, are very handy to make these vascular ligatures. It is to immediate ligature that one must give preference. In the cases where that is impracticable, where the ends of the vessel are concealed deeply in the tissues, and difficult to find, mediate ligature is resorted to. With a curved needle, a thread is passed round the blood vessel and the soft tissues surrounding it, and is secured with a straight knot.

Torsion, recommended by Amussat and more recently by Tillaux, may take the place of ligature for arterioles and veins of small caliber. With forceps, the bleeding stumps are taken hold of, gently drawn out of the tissues and twisted. The *illimited torsion* of English surgeons consists in twisting the blood vessels until they are torn apart. The effects are similar to those of the ligature, the external coat forming a kind of cap which covers the clot formed, and fixes it firmly. Ligature is surer than torsion; in arterioles of some caliber, the cellular coat may untwist and a secondary hemorrhage follow.

The *forcipressure* has distanced all other hemostatic processes. It consists in applying, upon the ends of the divided blood vessels, fixed forceps, which are left for a variable length of time, either until the blood vessel is closed by a clot, or only until the end of the operation, when permanent hemostasis will be realized by the ligature.

Recommended by Kœberlé and Péan, multiple forcipressure is now used everywhere, as a means of temporary or permanent hemostasis. Among excellent forceps recommended, those of Collin

are best and strongest (fig. 36). Their jaws are conical and dentated. When, during an operation, the blood suddenly escapes from the mouths of a divided artery, an assistant takes hold of them with the forceps, and keeps them off the field of the action of the bistoury. With these forceps, diæresis upon vascular structures can be made without arrests and without noticeable escape of blood. They can be applied in various numbers, as they are required; all are left in place until the end of the operation; they are pressed upon the small arteries for a few minutes only, and when they are taken off the hemorrhage has stopped. If large vessels have been divided, their ligature can be readily made. At times the forceps are left long

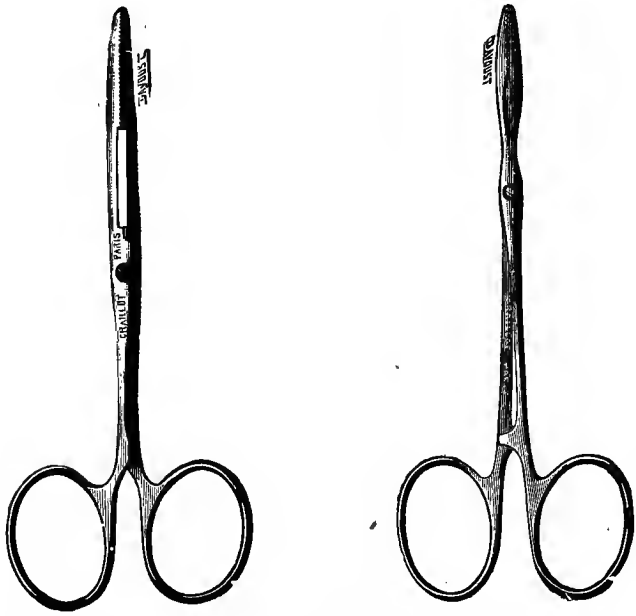


Fig. 36.—Forceps.

enough to produce a permanent hemostasis; when, for instance, they have been applied upon deeply situated blood vessels, difficult to isolate and ligate. They are then fixed between the various pieces of the dressing or between the lips of the wound. They are removed after 24 or 48 hours, according to the size of the blood vessels they served to obliterate.

The necessary forceps, threads, and all objects used, must be made antiseptic, an indispensable condition to obtain cicatrization by first intention, or if one wishes to avoid accidents by infection.

For wounds of cavities whose walls bleed abundantly, *plugging with Iodoformed gauze* is also a good way to obtain hemostasis after an operation.

Elastic ligature is an excellent means of hemostatic exeresis. Used first in human surgery (Dittel, Grandesso Silvestré), it was afterward tried in veterinary by Guérin, Rossignol, Nocard, Cagny, who have studied its principles and *modus operandi.* If it be applied to a certain thickness of living tissues, the stretched India-rubber cord acts in a constant manner, as long as it has not returned to its primitive dimensions; in proportion as the tissues are divided, the loop diminishes in diameter and produces its dieretic action upon the deep layers. This is a great advantage over the simple ligature, whose brutal, immediate action becomes weaker quickly and is exhausted when reaching large peduncles. As soon as the superficial layers are divided, the cord acts only as a foreign body; to complete the ablation, it is often necessary to apply a second ligature or to tie up the first.

The elastic loop is without action upon inert bodies, even the less resisting, or upon dead substances, but it rapidly divides the living ones; skin, muscles, blood vessels, tendons, and bones. Nothing resists it, and the diæresis is made without hemorrhage; the walls of the blood vessels collapse before they are divided, and this cavity is obliterated by thrombosis. Cicatrization is quick; and often the wound is relatively small. Its uses are numerous: its application is simple. A vulcanized tubular, or firm, cylindrical, or prismatic cord, of a size proportioned to the mass to be divided, is used. An assistant holds one end, the operator seizes the other, stretches the cord, rolls it round the peduncle; three or four times are sufficient; and, to fasten both ends, crosses them, passes them to an assistant, and passing an ordinary thread under their crossing, fastens them well together with a straight knot.

For the extirpation of tumors, when the neoplastic mass has a well defined peduncle, the application of the elastic loop is easy. When the tumor is wide and not well defined, it is proper to pierce it through with one or two metallic needles to secure the fixity of the ligature. Rossignol has succeeded in obtaining in fifteen days the slough of a tumor from the shoulder, having a diameter of 20 centimeters and weighing 16 pounds; and in twelve days, that of a growth of the hock weighing 3 kilog. Other analogous facts have been recorded.

Since the experiments of Rossignol and Cagny, the castration of lambs with elastic ligature is much practised. 2000 animals, 2 and 3 months old, were castrated, during warm weather, by Rossignol, with only 3 cases of tetanus. This process is evidently superior to "tearing." It is also good for cattle.* In Egypt, in 1885, Piot operated upon nearly 2,000 bulls and buffaloes, without an accident or complication of any kind. Disinfection of the scrotal region, soaking of the cord in the Van Swieten solution; afterwards, antiseptic washes, after six or eight days cutting away of the morti-

* We have successfully castrated two llamas belonging to the Zoological Garden of New York, and three camels of the famous Barnum & Bailey Menagerie, with the use of the elastic ligature. (T.)

fied tissues, and application on the stump of a coat of tar, previously submitted to boiling; such are the precautions to be observed. Generally, those operated upon can resume their work towards the fifteenth or twentieth day.

Elastic ligature has been tried for the castration of solipeds. Applied upon the exposed spermatic cord, as in the uncovered process, the rubber ligature amputates the testicle in two or three days. But serious complications (tetanus, septicæmia, peritonitis) have been so common, that this mode of castration has been rejected in ordinary practice. In 1880, out of 20 castrations, Tapon had 5 deaths. Pinel says, he was more fortunate in tying the ends of the rubber with a piece of twine. In this way, the spermatic cords can no longer be drawn up into the inguinal canals, so rich in connective tissue, and on that account so easily inoculated. Using antiseptic measures, this veterinarian had only one serious accident out of 400 operations. The application of the rubber cord over the skin, is followed by the slough of the testicle in 3 or 4 days; but there is *a large wound* remaining (Cagny).

Elastic ligature has other uses. When, in prolapsus of the uterus, the organ cannot be reduced, or is the seat of extensive lesion, a strong rubber ligature can be applied at its base, the organ amputated below it, the stump thoroughly disinfected and then returned into position. All hemorrhage can be prevented by the application of the Esmarch bandage before the prolapsed uterus is amputated.

Cagny has recommended elastic ligature for the amputation of the tail of a horse. The most painful part of this operation is not the section of the tissues, but the cauterization; and in certain breeds of horses, the application of the red hot iron gives rise to violent reactions. One may avoid the cauterization by placing, before the amputation, an India-rubber ring immediately above the place where it is to be made. Some say it must be left on for eight days, but it may be taken off after 24 or 48 hours. Its use in our hands for removal of large cap. elbow, has not given us good results, on account of the large wound left after the sloughing of the growth, which in one case required no less than three months before complete cicatrization occurred. Elastic ligature has also been used to obtain temporary hemostasis in bloody operations upon the extremities.

V.

CAUTERIZATION—FIRING.

We shall not stop for the consideration of cauterization with chemical agents. This was much practised in former times to slough altered structures or to destroy neoplasms; to-day it is almost abandoned. It is a long, painful process, and is not even good for most tumors; under their superficial layers when destroyed, the irritated neoplasm grows, granulates, and

spreads. A few cutaneous benign tumors, rebel ulcers and "canker" of the foot represent about the only actual calls for its use.

From the beginning of the art, at Cuidus and at Cos, actual cauterization was believed to be the most energetic therapeutic agent. Hippocrates thus spoke of it in one of his aphorisms: "What drugs do not cure, fire will; what is not cured by fire can be looked upon as incurable."[1] After having been used *largâ manu*, cauterization was ignored for many centuries. Solleysel rehabilitated it for our patients, and laid down its first rules in his "*Parfait Mareschal*" (1664.) "To well apply firing, three things must be observed: 1st, That the one who applies operate with light hand, and does not press too heavily upon the skin with the iron knife; 2d, that the instruments be only at a red and not a white heat; 3d, that they be heated only with charcoal. . . . . I have had firing applied hundreds of times in many places with great success; horses have always been benefited by it. . . . . It is of great importance to prevent the horses from scratching, rubbing, biting or licking the cauterized parts, since no matter how well the operation has been performed, if these precautions are not taken, the parts will be deformed. . . . . In firing, unless it is absolutely necessary, and then never in other than the necessary places, should the skin be cut; it should be cauterized by degrees without hurry, until it has taken a sherry color. . . . Time is necessary to fire well; and it gives better results if the firing is done with irons moderately hot, passed five or six times in the same line, than with very hot irons which cut through at once or burn only the hair, as blacksmiths do. . . . . When firing is finished, one may spread over the cauterized parts a layer of lard or of yellow wax, melted and mixed with melted black pitch; after nine, ten, or twelve days, all is washed every day with alcohol. . . . . Every one has his way of firing; some make use of silver knives, others of brass or copper irons: copper I prefer, as this metal is very good for wounds. . . . . The effects of firing are slow; I have seen animals in which the effects of firing were not fully realized for six months; it is an imperceptible resolution; time is required to produce the absorption and reduction looked for. . . . . The effect of fire lasts twenty-seven days, nine for its increase, nine for its developed condition and nine for its subsidence; the least time that ought to be given for one to see the good effects is eighteen days. . . . . Twenty-five years ago, to speak of firing a horse or to send it to the skinner were the same thing; to-day it is different; I have removed the fear that people had of it; experience had conquered."

In his "*Nouveau Parfait Mareschal*" (1741), Garsault reproduces the same principles, and recommends firing, "following as closely

[1] *Collection hippocratique*, trad. of Littré, vol. iv., Aphorisms, p. 609.

as possible the direction of the hairs, so that when they grow out again they may cover the marks." He advocates, also, firing as a preventive, as practised in Oriental countries. "The only reason preventive firing is not done in this country, as it is in others, is because of the scars, which will lessen the value if the animal is offered for sale; but if one wishes to keep his horse, firing of the legs will do it good."

The hippiatres of recent times have abused firing. Having but vague and incomplete notions about anatomy, they preferred it as a means of hemostasis. Although its use has been greatly restricted during this century, it remains yet in veterinary surgery a therapeutic method well established and daily used with success against numerous affections which have not yielded to other modes of treatment. No doubt it is painful, it imposes long rest, and at times leaves permanent marks; but compared with the advantages it offers, these objections are of little importance.

Among the uses of actual cauterization, the most common are for chronic affections of tendinous sheaths, of bones and of joints; synovitis, hydarthrosis, sprains, luxations, exostosis, periostosis, extensive callosities, caries, and necrosis. It is the most generally used curative agent for some tendinous lesions, amyotrophia, chronic inflammatory alterations of the connective tissue, and for various kinds of cysts. It is used also ordinarily for treating the old lymphangitic and phlebitic indurations, fistulæ, refractory ulcers, summer and virulent wounds, anthrax tumors, septic swellings.

There are two kinds of cauterization, the *superficial* and the *deep*, each of which is applied by various methods. *Cauterization in sheet* is not practiced; and the ignited substances, the moxas, are no longer used. As much can be said of *cauterization by radiation*, or of the method with *warm liquids* and of *mediate cauterization*.

The only processes used to-day are:

1. *Superficial cauterization*, in points or in lines, in which the instrument does not penetrate deeper than the dermis.

2. *Cauterization with fine penetrating points*, in which the skin is perforated through and through with one or several strokes of the cautery.

3. *Needle cauterization*, in which the instrument penetrates into muscles, tendons, ligaments, bones and synovial sacs.

4. *Subcutaneous Cauterization*, done after incision of the skin.

CAUTERIZATION OF SOLIPEDS.

For *firing in lines*, instruments having the shape of a triangular prism are used. (Fig. 37.) They are of small size for thin skinned animals; they are larger for those whose teguments are thick. The

cauterizing edge must be slightly convex, blunt throughout its whole extent, rounded at its angles; and its rod would better be moderately rounded in. With such instruments the uneven parts of the region can be well followed, and the heat evenly distributed. The active part of *point cautery* (fig. 37) is disposed in a conical form more or less elongated; it varies in size. For *penetrating* or *deep pointed firing*, a cautery more elongated than the preceding is used. Abadie has recommended an instrument with which he could run through the subcutaneous connective tissue and deep into the tissues. When one does not wish to go beyond the subcutaneous connective tissue, ordinary cauteries more or less elongated answer all purposes. *Needle Cauterization* requires very fine needles which can penetrate all tissues. At first iron needles, 2 millimeters in diameter, and one or two decimeters long, were used; heated to red heat, they were taken hold of with nippers and implanted in the tissues. Bianchi, Lenck, Foucher, have recommended cauteries having an olivary part, terminated by a point of iron or platinum. The most of those instruments with a separate needle cool off too quickly and burn the skin round the perforation. To protect the skin, Watrin had a little disk of metal placed between the needle and the olivary part of the cautery.

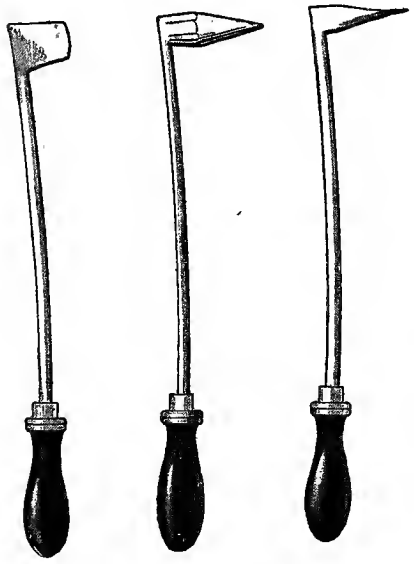


Fig. 37—Lines firing iron. Dots firing iron. Sharp pointed firing iron.

Bourguet (fig. 38), Vasselin, Hermann, and Ehret have invented the first cauteries with movable needles and independent heating. That of Bourguet is superior to all others, and we use it often at Alfort, with best results. A screw (A) regulates the penetration of the needle, which is heated in the interior of the heat carrier, a slight pressure from downwards upwards upon the branch F pushes it out; as soon as it is removed from the tissues, it is allowed to return to the heating mass, which is fixed by a spring (M). A screen protects the skin. Notwithstanding its apparent complexity, this instrument is remarkable for its solidity and the regularity of its working.

The *Paquelin cautery* (fig. 39) is based upon the property that platinum possesses, when once brought to a given temperature, of becoming incandescent in contact with a mixture of air and hydrocarbon vapors; and of remaining in this condition as long as the contact may last. The cauterizing part is screwed on a rod, and, according to needs, may be a point, a needle or a knife. The lighting is simple. The cauterizing part is heated with the alcoholic lamp; after a few minutes the bellows is called into play. The platinum reddens at once. The ordinary Paquelin is rather weak for large animals. Often, if the animal reacts much, the point bends, or becomes loose, or the rods more or less deranged.

The *Zoocautery* (fig. 40) is more solid and better adapted to our uses. Its construction rests upon the power of the platinum to remain incandescent under the action of the hydrocarbonaceous vapors, and upon its remarkable conductibility. The reservoir (A) contains a sponge moist with a small quantity of mineral essence; at one extremity is fitted a Richardson bellows; on the other is screwed a peculiar branch, carrying a cautery in point or in line, whose base is perforated with lateral holes, which permit it to act as a siphon. A tube inside carries the vapors of the essence to the point of platinum; a screw (H) allows the essence to burn in the siphon, or prevents its reaching the siphon by the central tube.

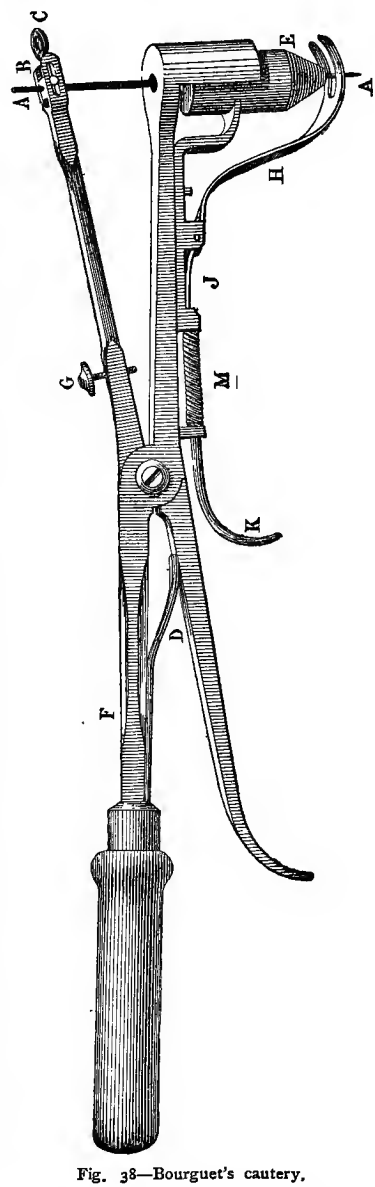


Fig. 38—Bourguet's cautery.

To make the instrument work, a small quantity of essence is poured upon the sponge, that which is in excess having been expelled, the cautery is screwed on the reservoir, and the bellows

adapted ; the screw H and the spigot B are now opened. The bellows are worked, the vapors of essence which escape by the lateral openings of the siphon are lighted, gradually the spigot B is closed until

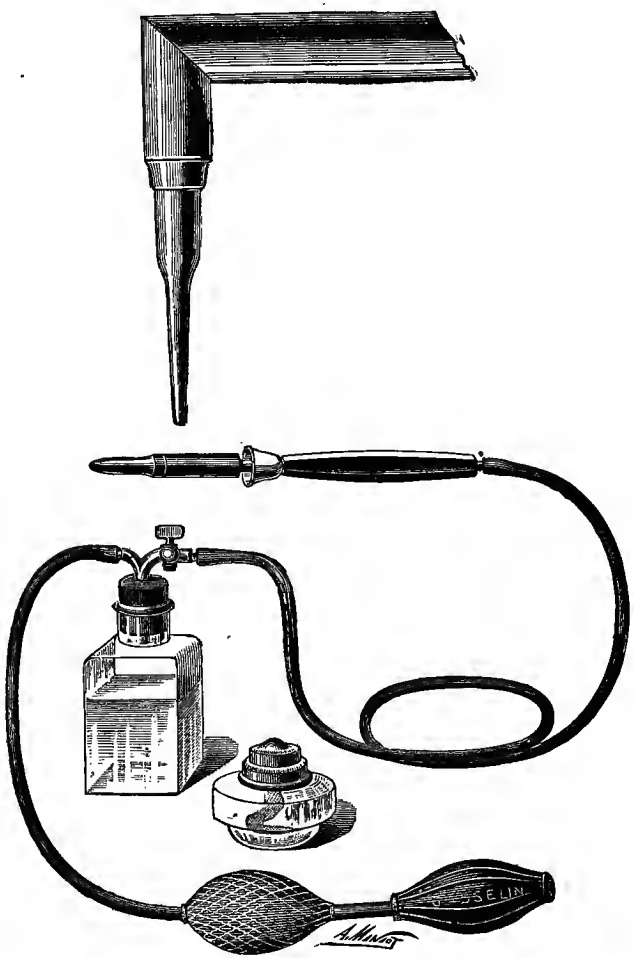


Fig. 39—Paquelin's cautery.

the flames do not come out any more. Soon the central tube reddens ; and the siphon being then closed by the screw H, the point of the cautery is soon seen becoming red in its turn. As the quantity of essence diminishes in the sponge, to keep up a sufficient quantity of heat, the spigot B has to be opened gradually.

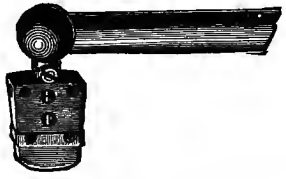
This cautery is very handy ; it permits rapid application of firing in superficial deep points ; but though the needle is made of iridized platinum, it bends just like that of the Paquelin cautery. This has

the more serious objection, however, that the assistant who has charge of the bellows soon becomes tired working it.

In the *cautery Paquelin de Place* (fig. 41) the heat is also furnished by the combustion of hydrocarbon vapors. For needle firing, one full needle is made to pass through the heating chamber, and when it is heated, is brought out by pressure on the conducting rod; when cooled off, the pressure is relieved and permits the needle to return into the heating chamber. Though not without advantages, this instrument is less handy to work with than the thermo or the zoocautery, and the cauterizing action of the hollow points of platinum is less active than that of solid points of iron or steel.

To heat ordinary cauteries, a forge or a heating furnace is used. Wood coal or coke is preferable to other coal. An assistant watches the process of heating, and when the instrument has sufficient amount of heat, he takes hold of it, passes a file over its sharp part and gives it to the surgeon.

Lagriffoul, Faugère, and Perrin have had the idea of using eoli-



Lines cautery.

Fine point cautery.

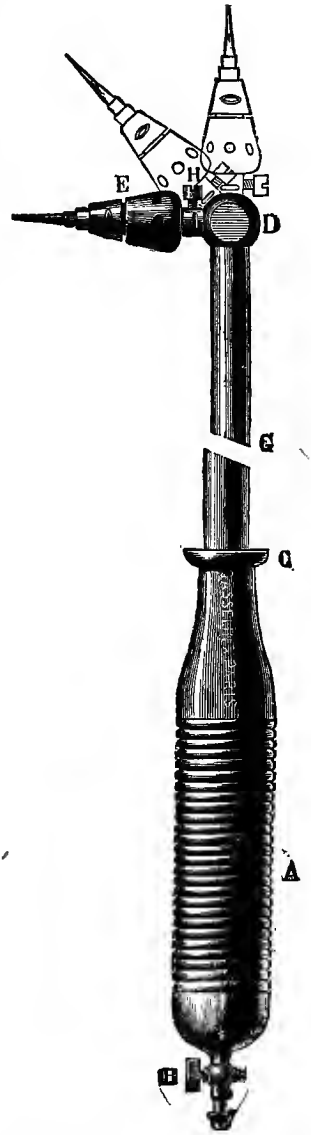


Fig. 40—Zoocautery; A, tank; B, cock; G, hollow stem; E, fire point; H, regulating screw.

piles like that of Paquelin. These instruments are useful and keep the cauteries clean and free from clinkers. Some are dangerous. That of Lagriffoul (fig. 42) is fixed on a table which carries a kind

of chimney where the flames collect and where the cauteries are held to be heated. The heating of the cauteries is done by the burning of some mineral essence poured into the lamp. The instrument will do its work from half an hour to two hours without refilling.

Whatever is the mode of firing, some general rules are to be observed. If possible, a favorable time should be selected. Spring and fall are favorable, and summer objectionable, as during that season the inflammation is often exaggerated and the itching intense, the animals scratch, rub, and bite themselves, so that, at times, serious accidents are the result.

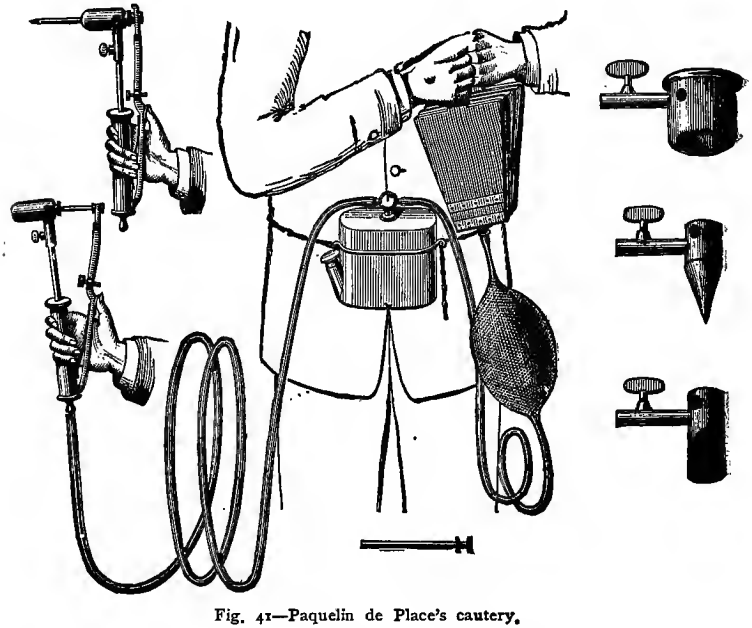


Fig. 41—Paquelin de Place's cautery.

The preparation of the animal is important. It should have fasted, if it is to be cast; if very strong and plethoric, its rations should be reduced for several days, and a laxative should be given. The region to be fired should be cleaned, all scabs brushed away, if there are any; the hair should be clipped with the machine or cut short with the scissors. For superficial firing, the hair should be left a little long; so that the instrument may be kept from sliding off the point or the line marked off, by a thin carbonized coat of burnt hair. For the deep cauterization of synovials, some antiseptic measures may be useful. The cleaner the skin shall be, the less the danger of infection after the operation. When firing is applied

to regions where the skin is very loose, it is wise to mark the outlines of the surface to be cauterized before the animal is thrown.

Quiet, unirritable horses will endure the operation well, in the standing position; a twitch on the upper lip and the foot raised are sufficient. Sometimes firing can be done in special regions, by putting the horse in stocks.

But when firing is very painful, it is better to cast the animal. If the operation is to be on the external surface of a leg, he is thrown

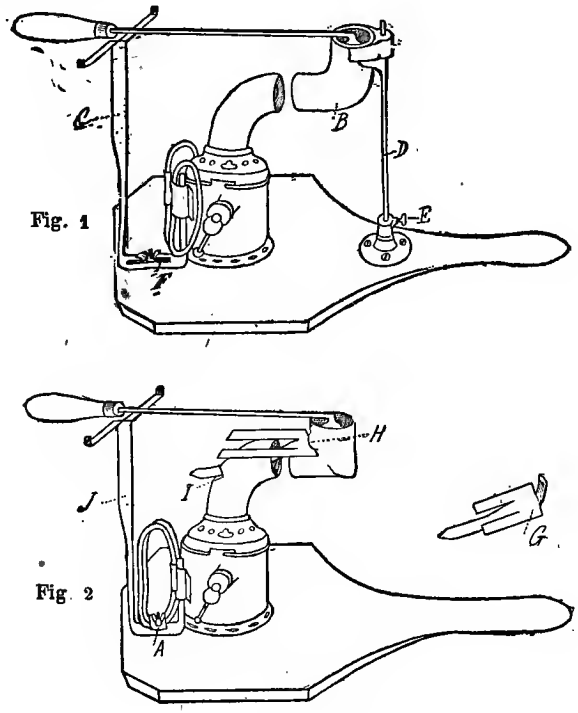


Fig. 42.—Eolipiles.

on the opposite side; if the firing is to be applied all round the joint, the inner surface should be operated upon first. When one fires, at one sitting, the legs diagonally opposite, the external face of one and the internal face of the other should be operated upon first; and when the animal is turned for the second part of the operation, the cauterized surfaces must be protected from the bedding by cloth.

The fastening of the animal varies with each particular case. Generally the leg to be operated upon is kept in the hobble; its congener is fastened either forward or backward, as the case may be. When the coronet or fetlock is to be fired, the best way is to secure both legs together, above the knee or the hock, with a rope, passed

in a figure 8 round both; then to take the diseased leg out of the hobble, pulling it forward or backward to operate upon. The hobble-stick is not necessary.

Let us consider the technic of line cauterization. (Fig. 43.)

When the subject is prepared and secured in good position, the operator marks the firing. Renault recommended that the lines should be parallel to the hair. Bouley, like Garsault, preferred them oblique. The transverse lines of the English are as good and

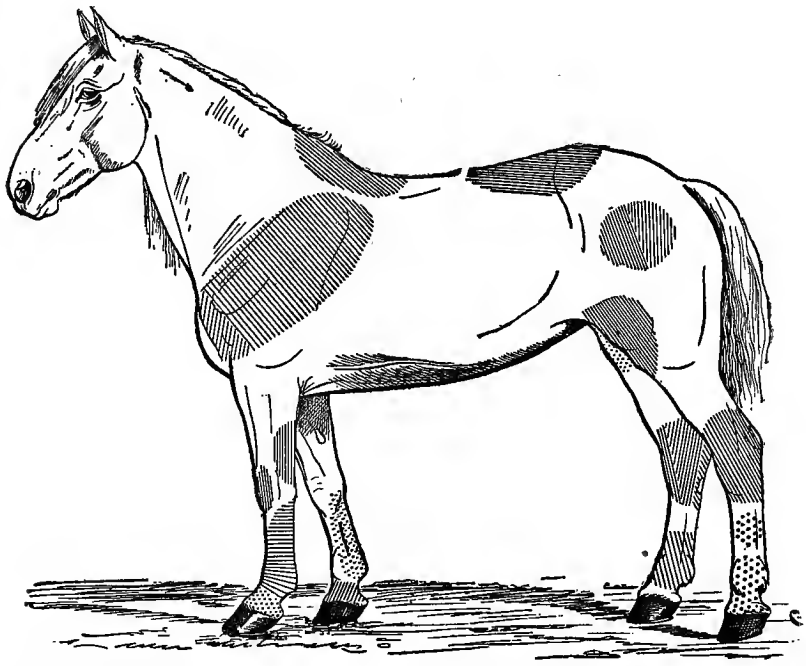


Fig. 43.—Cauterization of the principal regions where fire is generally applied.—Shank, fetlock, pastern and coronet of the left hind-limb: superficial point firing;—pastern and coronet of the left fore-limb: sharp point firing;—tendons and stifle of right limbs: stripe firing.

do not disfigure any more. The drawing of the firing is of little importance. Fancy drawings have long been abandoned. What is essential, is to make the lines straight, evenly distant, and extending somewhat beyond the diseased zone. Converging lines must not come together nor cross each other, as the cutaneous portions of the angles would be exposed to too much heat and might slough. When the firing is to envelop a section of the leg, a vertical line should be drawn in front and behind, to indicate where the lines of the lateral fans are not to extend on the opposite face.

The spaces to be left between the lines vary according to the

thickness of the skin and the extent of the region to be cauterized. Closed and superficial lines are preferable to those made far apart and deep. Generally they are separated by one to one and a half centimeters. Once marked, firing must be made with the proper degree of heat. The cauteries, heated to a dark red or bright red heat—*temperatura maxima*—should be slowly drawn over the lines, without pressure in lowering or raising the hand, according to the surface,—the instrument always held perpendicular to the skin. It should be drawn towards the operator or pushed away from him, but never contrary to the growth of the hair. It should not be passed twice in succession over the same line; the firing should be carried the whole extent of the region, beginning at one end, passing successively to the other, and returning to the starting point. In this way, one may avoid the destroying effect of the heat. When the surface is small, one should proceed slowly and leave a little time between the applications of the instrument.

What are the signs which indicate that the firing is sufficient?

The aspect of the bottom of the lines, the exudation which takes place, the state of infiltration of the skin and the more or less marked rise of the epidermis, almost always tell exactly, providing the operation has been performed according to the established rules. There are three degrees of firing. According to the first, the lines, not deep, have a few drops of serosity oozing from their borders; their bottom is slightly yellow; the skin slightly infiltrated; the epidermis still adherent. According to the second, the lines are deeper; their bottom a clear yellow; the oozing of serosity greater; the epidermis is easily raised. According to the third, the skin is almost entirely cut through; the edges of the lines have a tendency to separate widely and may leave ugly cicatrices; their bottom is straw yellow, filled with abundant serosity; often the skin is covered with little blisters. The cautery, heated to a bright red color, should be carried along each line five or six times for a light firing, eight or ten for an ordinary, from twelve to fifteen for a strong cauterization. These numbers, of course, will vary with the weight and the temperature of the instrument, the dexterity of the operator, and the condition of the skin.

Superficial point cauterization may be performed in many regions standing. The points are placed in a quincunx. In general, points and lines are separated by the same space. They can be made closer at the places where the firing is to be more severe.

The application of the points is repeated according to the intended strength of the firing. As in line-firing, the strength is recognized by the color of the skin at the bottom of the points, by the quantity of serosity thrown out, by the condition of the epidermis between the points. To apply the pointed cauteries once or twice only and

cover the parts with a blister, is a process very advantageous when one desires to avoid disfigurement.

To U. Leblanc is due the introduction, into our surgery, of *cauterization in deep fine points*, which he made known in 1836. The characteristic of this method is the piercing of the skin through to the subcutaneous connective tissue. The points are applied in the same way, but somewhat closer than in superficial firing. The instrument is slightly pressed upon, so that with one or two strokes the skin is perforated.

The advantages of this mode of cauterization are facility and rapidity of execution, and more intense and deeper action. Leblanc used to run through the skin with two, three or four strokes of the instrument, and complete the operation with a blistering application. During summer, we apply the instrument only twice. When the cautery is applied three or four times, especially during the hot months of the year, it is prudent not to use the blistering process, until a few days after—if the firing is not sufficiently strong.

For a long time, the absolute respect, in veterinary surgery, for synovial membrane, was dogmatic. It was known that happy results had been obtained by Basch, Bœttger, Fischer, Robertson, and Bruche, with fine punctures of synovial sacs with the red iron or with the bistoury; these practitioners were not imitated, their advice remained a dead letter: so many unsuccessful attempts were known, though they had not been published.

In 1847, Rey had already observed the harmlessness of the introduction of fine incandescent needles into the synovial membrane. Twenty years later, Bianchi made known his experiments of the *Treatment of Synovial Dropsies with Heated Needles.* The new method, studied and discussed by Abadie, Bouley, Foucher, Peuch, and Lenck, aroused much opposition at first. It has, however, resisted all attacks; and the number of its advocates is daily increasing. When well performed, it is harmless, even for articular synovial membranes; and for intensity of action, and therapeutic value, it surpasses all others. It is indispensable to use *very fine points*, the diameter of which does not exceed one millimeter and a half. In preference to the ordinary elongated cauteries, needles of uniform diameter should be used; such as that of the Bourguet cautery, or the platinum point of the Zoocautery.

The dots are arranged in a quincunx, one centimeter apart. The technic is somewhat important; the heated needle is implanted in the tissues to the desired depth and immediately taken out. When it is over the course of blood vessels and nerves, it should not go deeper than the subcutaneous connective tissue. There is no harm in inserting the instrument several times in the same dot, when one

is operating on fibrous or bony tissues; it is necessary to do so, if one desires to produce a strong effect, though this is dangerous, even with fine needles, for synovial membranes. We have seen carpal synovitis follow an application made twice in the firing of a tendon. Dots made with the red iron are aseptic, and such they remain as deep as they go, when made small, fine, and with one stroke. It is not necessary, however, for synovial dropsies, that all points shall be *perforating*.

Give a single stroke for synovial membranes and two or three for other tissues; in some cases complete the operation with a blister; such are the rules of the needle cauterization.

Shall the cauterized regions be recovered with emollient applications? The observations of Renault, Favre, Gourdon, and Peuch have shown that greasy substances assist suppuration, interfere with cicatrization, and increase the size of wounds and of cicatrices. Their immediate use after cauterization is condemned. When the inflammatory reaction is too severe, antiseptics may be resorted to (lotions or powders). If cauterization is not sufficient, a stimulating friction (a blister, mercurial or red precipitate ointment) must be made after the second or third day. Notwithstanding the absence of exudation in too strong firing, practitioners know how to distinguish it from weak firing.

The *consecutive phenomena of firing* vary much, according to the method used. If the firing has been superficial, no matter in what shape, during the days following, the region is swollen, and an exudation more or less abundant is thrown out at the bottom of the dots or of the lines, which soon dries up and forms yellow grayish crusts, covering the entire region; the resting of the leg is very painful, the lameness is apparent and a severe itching exists. As long as this lasts, the patient must be closely watched; and to prevent his biting and rubbing himself, he has to be tied up close to his manger, with a cradle or a side bar fixed to his halter and surcingle. The crusts become loose towards the eighth, tenth or fifteenth day; to accelerate their dropping, frequent lotions of warm water may be applied, in preference to poplar ointment; if the skin has a tendency to crack, it may be covered with borated vaseline or glycerine. Later on, the eschars produced by the cautery drop off themselves; when a great thickness of the dermis is involved, they sometimes adhere longer, and their sloughing takes place by a suppurative process, which leaves exuberant granulating surfaces, followed by permanent scars, no longer concealed by the new growth of hair.

While these phenomena take place on the surface of the skin, the

subcutaneous tissues are inflamed, and in a state of hyperæmia; an abundant exudation infiltrates them, and an active cellular proliferation takes place in them; followed by resorption, induration and compression, and ultimate and salutary effects of the caloric action.

The effects of firing in deep points are more apparent than those of superficial cauterization. The swelling of the leg is often greater, although the serosity flows abundantly through the perforations of the skin. Applied in this manner, says Leblanc, "firing leaves as many cicatrices on the skin and in the cellular tissue as there have been dots made. Those cicatrices, numerous and very close together, produce a good effect; they form a kind of permanent compressive bandage, far superior to any other." Indeed, it is certain that the retraction of these little islands of inodular tissue have, through the medium of the skin, an active compressive effect upon the diseased tissues, analogous to that which would be made with a solid elastic band. The care afterwards is the same in this as it is in superficial firing.

The phenomena following needle-firing vary according to the depth of the punctures and the nature of the tissues involved. But there is always a great inflammation of the cauterized region, the leg becomes much swollen, at times very hot and painful, and the animal is affected with a more or less marked reactive fever. When the firing has been applied upon a synovial tumor, "besides the serosity, synovia flows, sometimes in large quantities, which forms, upon and below the cauterized surface, a grayish yellow albuminous coat, running down the leg to the ground, and sometimes soiling the bedding."

After two or three days, this serosity dries up, the holes become obliterated, and the flow stops. The crusts fall off during the second week, the eschars are eliminated towards the twentieth day, leaving in their stead little rosy cicatrices. The swelling of the region lasts sometimes very long; exercise and massage accelerate its decrease. The hair grows quickly and covers almost entirely the hairless spots of the cauterization. This is one of the great advantages of the method.

Whatever is the degree of firing or the mode used, a certain length of time for rest must be allowed to the animal operated upon. Generally after 8 or 10 days it may resume exercise, walking daily for 20 or 30 minutes. A week or two later, it can resume work. A longer rest is advantageous, however, for tendinous lesions, some forms of spavin and other affections.

Accidents of firing are common. The straight cautery may cut through the skin and give rise to a great separation between the lips of the line; capillary hemorrhages and excoriations of the skin

are not uncommon. These are easily avoided by careful attention to the technic of the operation.

More serious are the sloughs of skin and defective cicatrization, which are the results of excessive cauterization. When firing is followed by very severe inflammation, so that sloughing is threatened, care must be immediately taken to prevent it. A fine cold spray, repeated often, is one of the best methods to use ; it cleans the region and removes the irritating exudation, which increases the inflammatory phenomena. Astringent lotions and compresses (white lotion, alum water) have their advocates. Tepid antiseptic irrigation, the use of powders of iodoform, alone or mixed with tannin, are preferable. Nocard gives preference to atomization of iodoform ether : "They stop the itching and prevent the microbic infection of the wounds." Let us also mention, but proscribe entirely, the practice which some have of applying a blistering preparation to the inflamed surface. Hemorrhages following the puncture of a vein or artery with the heated needle are not dangerous ; they stop of themselves, by pressure or the introduction of a small hemostatic, a piece of cotton. Other lesions, such as tendinous or cartilaginous quittors, arthritis, and synovitis, we have already shown how they are to be avoided.

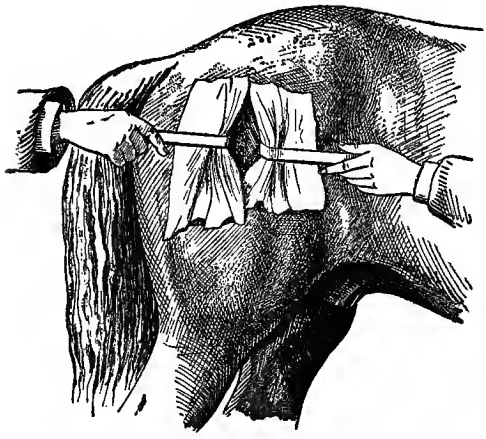


Fig. 44.—Subcutaneous cauterizing. (Lanzillotti Buonsanti.)

Subcutaneous cauterization, recommended for a long standing lameness of the shoulder or of the hip, has two principal steps. (Fig. 44.)

1. *Incision and detachment.*—After the hair has been shaved over the region to be operated upon, a vertical incision is made, 8 or 10 centimeters long. Both cutaneous edges are loosened from the tissues underneath for a certain distance, and then separated from each other with spreaders, after being covered, for protection, with a wet cloth.

2. *Application of firing.* Upon the exposed parts, a certain number of points, superficial, or more or less deep, is applied, following the same rules as for ordinary modes of cauterization. For a superficial

firing, 5 or 6 applications of the points are sufficient. With the special buttoned cautery (fig. 45), Lanzilloti Buonsanti scarifies a thin layer of tissue. Brambilla makes several small incisions through the skin and, in each of them, applies a firing point.

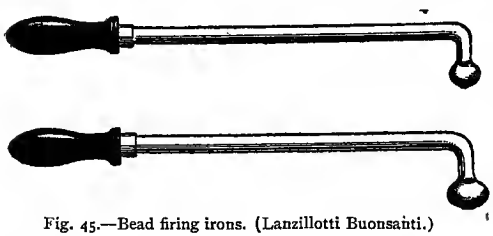


Fig. 45.—Bead firing irons. (Lanzillotti Buonsanti.)

The care afterwards is that required by all suppurating surfaces. Generally only a linear mark is left after the operation. At times, however, there is an irregular callous cicatrix. (Peuch.)

CAUTERIZATION OF BOVINES.

Firing is used less for those animals than for horses. But the good results that may be obtained have been made familiar by the writings of Cruzel, Roche-Lubin, Festal and Lafosse.

The technique differs little from that followed for horses. The skin, thick and "rich in serosity," can longer endure without accidents the application of the cautery. But the thickness of the dermis is very different according to the region; it varies in the proportion of one to four. From this point of view, Bouley had made a progressive scale of the principal regions upon which operations are generally performed: 1st, *Degree*, Inguinal region; 2d, internal face of the hock, canon, and posterior face of the knee; 3d, point of the shoulder, and outside of the stifle; 4th, external face of the hocks, fetlock, and coronets; 5th, front, back, and loins; 6th, hip joint; 7th, anterior face of the knee.

Lafosse says: "It is necessary to submit the steer, before the operation, to a strict diet of at least 12 hours, and to be sure that his rumination was perfect before his last meal, so as to avoid tympanitis, which even then may take place, although these precautions have been taken—especially when the firing is to last some time." These precautions are not necessary when the animal is operated upon standing up. As a general thing, all that is required is to place him in stocks or under the yoke; he is seldom thrown down. The hair is cut short upon the region. It is better to use instruments of which the point or cutting part does not widen out too rapidly; for, as the cautery goes deeper, it would generally leave large external wounds.

For superficial lined or dotted firing, the rules followed with horses are applicable to cattle, increasing one-third the number of applications of the instrument; of course, taking note of the region where

the operation is performed. The signs of the three degrees of cauterization remain the same. One must bear in mind, however, that "seldom are the eschars thrown off by suppuration; when they drop, cicatrization is already complete underneath, and the hair growing." (Lafosse.) Since animals may do some mischief with their tongues, some precaution should be taken to prevent this.

Deep and needle firing also give excellent results in the case of cattle.

Faulon prefers the simple top-shaped cautery to that of Bourguet, though this or the Zoocautery work well. With one stroke, the needle, heated to a clear red, is pushed to a depth of 2 centimeters and a half, and may be inserted eight or ten times in each perforation, when the firing is done for tendinous or bony lesions. One stroke is sufficient for synovial.

After the firing, Faulon recommends the application of the ointment of iodide of lead with free iodine, made of:

Iodide of Lead	10 grammes
Iodine	2 do
Lard	30 do

In synovial dilatations, tendinous or articular swellings, especially if the firing has been light, he paints the region with one of the following:

Laurel Oil	30 grammes
Croton Oil	0 gram 05

Or

Oil of Turpentine Laurel Oil	aa

During the first days, the patients are kept in the barn, on clean bedding; the crusts and scabs fall off from the 10th to the 15th day; the eschar after 20 or 25 days.

Cauterization is little used in the treatment of small domestic animals. Firing, however, might be efficacious for bony and articular lesions and paralysis met with in *dogs;* but often its action is imperfect against chronic articular diseases, especially the dry femoro-tibio-patellar arthritis so common among those animals.

Superficial firing has given, according to some authors, recovery from lamenesses due to exostosis. Superficial points or lines are applied with light instruments. Four to six applications are sufficient. We use for our patients the penetrating needle of the Zoocautery, and for bones, tendons, or synovial membranes we make but one stroke. We place a wadded dressing over the part with a protective bandage. The muzzle has often to be put on.

SECOND PART

SECOND PART.

DISEASES COMMON TO ALL TISSUES.

CHAPTER I.

INFLAMMATIONS—GANGRENE—FOREIGN BODIES

I.

INFLAMMATION.

Whatever conception one may have of inflammation,—so varied may be its forms and causes,—it has never ceased to be a process that is met with in many of the very frequent diseases; and as it is yet "the principal phenomenon of pathology," as in the past, it is proper to consider the general precepts for successfully overcoming it.

The removal of the cause or the attenuation of its effects is the first thing to be considered in all cases of phlegmasia. If the inflammation is due to a foreign body implanted in the tissues, it should be extracted as soon as possible; if mechanical irritations keep it up—the collar in the case of a dog, the harness in the case of draught animals, the shoe in some lesions of the foot—they must be removed; and again, if, as observed in some skin diseases (eczema), or those of other tissues (rheumatism), the inflammation is due to a dyscrasical or infectious cause, an internal treatment must be instituted.

Another precaution, which should be taken in all cases of inflammation in the beginning, is to insure the immobilization of the diseased part, and to keep it in a state of rest as complete as possible.

Aseptic traumatic inflammations may be seen with various degrees of intensity, but they are seldom violent, and they naturally have a tendency towards resolution. Even the most severe do not resist for any length of time a well directed treatment. In their first stage, they are ordinarily treated with cold applications, with which one tries to control them, to moderate the congestive tendency, and to prevent the interstitial hemorrhages. Cold (water, ice, snow) produces a constriction of the tissues, a contraction of the blood vessels, and diminishes the hyperæmia of the inflamed parts; under its influence, the heat, swelling and redness diminish. But its application must be long or continuous; if it is often interrupted, a reaction will follow the ease temporarily pro-

duced, and the benefit of the treatment will be lost. It is especially true in a limited phlegmasia that refrigerants are useful. Where cold water is applied in affusions or fomentations often repeated, or by long immersions or continued irrigation, its action is almost always beneficial, and in many cases will be sufficient for simple phlegmasia. Cooling mixtures, much used in days past, are now abandoned, as is also refrigeration obtained with atomized liquids (ether).

The experiments of Bayer have proved that irrigation and cold baths are superior to all other modes. The mud of clay, with addition of common salt and vinegar, is irritating to the skin; it may produce cracked sores, especially on the side of the flexion of joints.

Against some inflammations, astringent solutions are still much used (alum, metallic sulphate, salts of lead, and a mixture of alum and lead).

Cold and astringents are not advised for any external inflammatory affection in any stage. Not only are they useless in infectious phlegmasia, but they may be injurious when there exist in the affected region extensive disorders, when numerous vascular currents are obliterated, and when tissues, bruised and ischæmated, seem threatened with gangrene.

To assist the return of the circulation and stimulate the nutrition of these tissues, other means are necessary, among which damp heat comes in the first rank. Warm water (40–50 deg. C.) renders greatest service in the treatment of external phlegmasia, especially when situated in the inferior regions of the extremities. Warm affusions, damp compresses, especially balneation, have a most favorable action in the generality of cases where phlegmasia is recent, particularly when the tension of the tissues is severe and the pain acute: the inflammatory phenomena become circumscribed and diminish, the swelling and the pain subside. When these are excessive, it is advantageous to bring into action, upon the inflamed tissues, narcotic or analgesical substances. The ointments of the old pharmacopia should be ignored to give preference to the preparations with base of vaseline: vaseline, 100 grammes; cocaine, 2 grammes; or, vaseline, 100 grammes; boric acid, 10; antipyrine, 10; iodoform, 2. (Reclus.)

Subcutaneous or submucous tissues, when inflamed, become phlegmonous, even when the surrounding tegument shows no apparent interruption of the continuity. Warm water is again very advantageous to conjure this complication. It softens fatty matter dried on the surface of the skin, loosens it, and produces a slight antiseptic effect.

Irritants—revulsive or vesicatory agents—are at times used when one wishes to accelerate a process or to substitute an artificial for a morbid phlegmasia. It is thus that the reactionary inflammation is excited in "stickfasts," "scabs" of the skin, by the applications on their borders of a vesicating preparation; it is also in this way that beneficial inter-

ference is obtained against some eczematous dermatitis by slight cauterization of the diseased surfaces with solution of nitrate of silver or nitric acid. At times, when the tissues are much swollen, scarifications are useful; blood and serosity escape from them, the tension of the inflamed parts is diminished, the pain reduced; but the objection to them is that they expose the tissues to infection, if they are not made aseptically, and the region covered afterwards with an antiseptic dressing or damp compresses. Deep scarifications may bring on cartilaginous quittor in cases of acute inflammation of the skin of the coronet, or disease of the withers or of the poll, if the phlegmasia exists in these regions; in both cases the complication exists on account of an inoculation produced during or after the operation.

Almost all acute surgical phlogoses are *infectious*, brought on by micro-organisms. Prophylaxy, for such as can be cured, is said in two words: asepsis for the wounds of operations and antisepsis for accidental wounds. As soon as a microbic phlegmasia exists, the agents which have given rise to it must be destroyed by an antiseptic treatment, or their pullulation must be arrested. One method consists in applying to the inflamed parts frequent warm lotions of corrosive sublimate, carbolic acid, or creolin solution: they are especially useful in inflammatory diseases of the skin and of mucous membranes, as there is danger of the extension of the process to the subcutaneous connective layer. This treatment cleans off the surfaces, renders them aseptic and protects them against complications.

When the region permits it, the application of compresses, dipped in the same solutions and often changed, is to be resorted to. If poultices are to be used, they must be prepared with phenic or creolined water. Continued immersions or baths in a warm antiseptic solution are most useful, and in the case of small animals nothing is easier. They can be used for large animals when the inflammation is located in the foot or in the lower part of a leg: a large basin, tub or pail, resting on a bed of straw, and containing a weak solution of creolin (2 p. 100), carbolic acid (2 p. 100), or of corrosive sublimate (1 per 1000), answers the purpose, the diseased part being soaked in it for 20 or 30 minutes. Warm antiseptic compresses and irrigations or baths give the best results in the treatment of phlegmasiæ of the skin and of the mucous membranes (vulva, vagina and rectum), in periarticular inflammations, ulcerated lesions, diphtheritic lesions, and, in general, in all microbic affections. The liquid, absorbed by the cutaneous pores, penetrates into the tissues and into the lymphatics, and produces a most remarkable effect: the swelling diminishes, the pains subside, the tension becomes less, the phlegmasia is arrested and soon goes away. In numerous cases which look threatening, where suppuration seems likely to be abundant, recov-

ery takes place in a few days, and if an abscess is formed, it always has small dimensions. In cases of lymphangitis of the extremities, so common among horses where there are wounds of the digital region, this treatment renders the greatest service. During the intervals between the baths, the diseased part must be covered with antiseptic compresses.

There are specific inflammations which require a very rapid interference and more energetic means, such as the carbuncular and septicæmic phlegmasiæ, when they are situated superficially and detected early. With them, one must resort to the destruction of the inflamed parts, or make in them deep scarifications or punctures with the hot cautery, and introduce deeply into the tissues bactericide solutions. (See *Anthrax* and *Septicæmia.*)

In inflammation of the subcutaneous tissues—connective layers, muscles, tendons, articulations and periarticular structures—when the pain is very slight or has been subdued, compression and massage constitute an excellent treatment, of which we shall speak later. According to the place of the diseased region and the degree of intensity of the inflammatory phenomena, compression should be made with a wadded dressing or by the application of bands of flannel or linen, or of the elastic bandage. When it is likely to be a little severe, as the case may be with the elastic band, it must be used only at intervals, now and then, as otherwise cutaneous necrosis by ischæmia might take place. Before applying a compressive bandage, it is advantageous to submit the engorged part to methodical massage. The technique of massage is simple: The region is covered with vaseline, and rubbing or pressing is made upon it with the full hand, or the palmar surface of the thumbs. *These pressures, or "passes" must always be "centripetal,"* made in the direction of the venous and lymphatic canals. In some regions, the extremities especially, it is necessary, in order not to be hindered by the hair, to cover the skin with a smooth tissue or a band of parchment. Massage for five or ten minutes is sufficient. Light pressures are made first to numb the swollen part, and are gradually increased in force. These manipulations help the resolution by a mechanism easily understood: the clots of blood of the connective lamella are crushed, the exudations spread and are distributed into a wider cellular territory; the resorption of the sero-sanguineous infiltrations is made active, since it takes place through more numerous channels.

Chronic inflammations are also treated by compression, massage and alterative applications, exutories or cauterization. The last is the best means for obtaining the destruction of indurations following old phlegmasia.

Some chronic inflammations are brought on and kept up by special parasites. To this group belong actinomycosis and botryomycosis. Up to late years extirpation was the only treatment of the new formation

due to these mycosic processes. To-day we have recourse to a specific medication: the administration of iodide of potassium internally, by the use of tincture of iodine, applied externally by painting or by injections. (See *Actynomycosis* and *Botryomycosis*.)

For the horse, iodine administered internally and injections of tincture of iodine, pure or diluted (tincture, 4; iodide of potassium, 5; water, 20), have seemed to us to be a good treatment for some purulent old phlegmasiæ which do not belong to botryomycosis.

II.

ABSCESS.

The great diversity of the clinical and anatomical characters presented by purulent collections admits of the following classification: *warm* or *acute* and *cold* or *chronic abscesses*; *superficial* and *deep abscesses; abscesses by congestion*, forming in dependent regions; *general abscesses*, developing in the course of specific diseases (distemper, glanders); *metastatic abscesses*, appearing secondary to a suppurating lesion, as the result of a "metastasis" of the pus, and well characterizing pyohæmia; *critical abscesses*, occurring in the course of some internal diseases and coinciding with an improvement in the general condition; *sudden abscesses*, which, in some animals exhausted by age, work, or previous diseases, appear suddenly, without noticeable local reaction; *urinary* or *stercorous abscesses*, which follow the infiltration of urine or of fœcal matter in the substance of the tissues.

With the exception of some organs of obscure vitality (epidermis, hoof, teeth and cartilages), all tissues may become the seat of abscesses. These may therefore be seen almost in every part of the organism. They are frequent in some regions (maxillary space, poll, neck, withers, point of the shoulder and inferior part of the legs), and again rare in others (abdominal walls, croup, gluteal region and thigh). Venous and lymphatic abscesses are a great deal more common than arterial. Muscles and bones are less affected with suppuration than the skin and connective tissue. Generally, it is in this last that absesses develop: it is this which offers the greatest facility for pyogenesis.

Suppurative inflammation may be the result of the effect of numerous causes, but it is generally due to traumatic action. Some absesses, consequent upon the extension of the inflammation, occur in the neighborhood of the primitive lesion, or at some distance from it, in the lymphatic vessels or their collecting glands. Our publications contain a large number of curious observations about superficial abscesses, due to foreign bodies which have travelled a distance more or less great,

through tissues (projectiles, needles, nails and other sharp metallic bodies swallowed by cattle, etc). The pathogeny of some varieties of abscesses (critical or sudden) is yet imperfectly known.

Suppuration does not establish itself with the same facility in the various domestic species; under the head of "pyogenic aptitude," or the frequency of abscesses, these species are arranged in the following order: horses, sheep, swine, dogs, cats and cattle.

Among horses, warm and cold abscesses of every size are very common. Among cattle, they are undoubtedly less frequent, less rapid in their development, and ordinarily are surrounded by a thick, hardened layer; although among young animals principally acute diffuse abscesses are also observed. Among dogs, diffused abscesses, "in sheets" (*en nappe*), with bloody pus and with copious œdema, are frequent.

The bacteriological researches of the last twenty years, especially those of Rosenbach, Ogston, Strauss, Roser, Socin and Garré, have shown beyond a doubt the microbic origin of surgical suppurations. All phlegmasiæ which bring on suppuration are the work of pyogenic microbes. The staphylococcus albus and aurens, the streptococcus pyogenis, and that of Schutz (microbe of distemper), are the most frequent. The yellow staphylococcus of Babes, the citrinus, the fœtid *bacillus pyogenis* of Passet, the pyogenic microbe of Pasteur, *bacillus coli*, and several others, whose presence has been detected in the pus of some abscesses, have a less important part to play. According to Lucet, among cattle, ordinary abscesses are due to special micro-organisms.

The pyogenic agents penetrate the tissues through the presence of a wound or the interruption of the continuity of the epithelium or epidermis; often, also, they are carried into them by sharp substances. Suppuration does not unavoidably follow in all cases where the animal tissues are thus invaded by these microbes. Unless there is additional help (local anæmia and alterations of anatomical elements), "positive inoculations" ordinarily require a large number of microbes. Fehleisen tells us that sometimes one cubic centimeter of a culture of staphylococci or of streptococci is necessary to bring on suppuration. Watson Cheyne estimates that for an abscess in the rabbit—an animal whose "pyogenic aptitude" is well marked—250 millions of cocci are required to make the tissues react, and Bujwid, in order to reach the same results, had to inject several millions of staphylococci.

Several authors (Ponfick, Gravitz, de Bary, de Christmas) have succeeded in bringing on suppuration in subjects from among certain species of animals by injecting aseptically, under the skin or in the eye, amicrobic irritating substances (nitrate of silver, mercury, or oil of turpentine), or sterilized cultures of pyogenic microbes. It has been

recognized that the products of the secretions of the germs of pus are themselves phlogogenic and pyogenic. Arloing has observed that the toxines, elaborated by the staphylococcus aureus, produce an active cellular hyperplasia, the rapid death of the newly formed cells, a dissolution of the intercellular substance, and, by reflex action, a vaso-dilatation which accelerates the diapedesis. Then, in last consideration the microbes of suppuration would stimulate it by the pyogenic substances that they produce, and suppuration would be but the effect of a reaction of the tissues against some irritating substance, whether produced by living beings or others of a purely chemical nature.

But, interesting as those data of experimentation are, they are not to be taken into consideration from a practical point of view. All suppurative inflammation that we meet with among our patients, is to be regarded as microbic ; all is to be considered as the result of an infectious process.

In general, phlegmons are isolated occurrences, with a more or less rapid development ; it is not, however, rare to observe several simultaneously on the same subject, either in the same, or in different regions. We have seen on one leg of a horse or of a dog, numerous cutaneous and sub-cutaneous abscesses, brought on by the two staphylococci. Eberhart has described a kind of " phlegmonous diathesis," which, in one case of a horse, was manifested for seven months by abscesses on the four extremities. Hübner treated a horse upon which, in the course of two months, 250 abcesses appeared ; some of these were the size of a child's head.

Whether the development of the abscesses be quick or slow, whether the local phlegmasic phenomena be slightly marked or acute and generally disturbing, the signs obtained by the exploring puncture of a tumour rarely leave room for a doubtful diagnosis. In doubtful cases, that of an abscess of the thoracic or of the abdominal walls, or of deep abscesses of the neck and extremities, the nature of the diagnosis must be at once established by a probing aseptically performed.

An antiseptic treatment of any traumatism is the surest way to avoid abscesses. During winter and rainy seasons, wounds of the lower parts of the extremities, soiled with mud, are often complicated by gangrenous phlegmons. These can be prevented by disinfecting the wounds and covering them afterward with a dressing, or with a coat of oil of cade or of tar. (Möller.)

Let us first consider the indications of the therapeutics of WARM ABSCESSES.

We have seen the means by which acute inflammation, threatening

suppuration, can be overcome. By tepid antiseptic compresses, warm baths, emollient and analgesical preparations—if pain is great, scarifications made with care—sometimes the metamorphosis of the phlegmon into an abscess may be avoided ; but this is only in a limited number of cases. When the phlegmasia is of an infectious nature, the abortive treatment almost always fails. When once the pyogenic microbes have collected in a mass in the inflamed tissues, suppuration is scarcely avoidable. In days past, the absorption of the pus of recent abscesses of small dimensions was often attempted, by making, upon the region where the purulent collections existed, repeated applications of camphorated ointment. This treatment was sometimes successful in the case of man (Velpeau says he used it with advantage) ; but the cases where it proved successful were exceptional. This method is now abandoned.

In order to make the pyogeny active to reduce to a minimum the duration of purulent infiltration, and to precipitate the formation of the abscess, sometimes emollients, sometimes vesicating agents, are used. In general, as soon as the inflamed tissue suppurates, the pain resulting from the inflammation diminishes ; if it continues sharp, one may, in the case of irritable subjects, continue the measures prescribed for acute inflammation. For a long time, the ointments of poplar, belladona, camphor, and the camphorated and opiated oils were the most generally used agents ; many veterinarians employ them still. Emollient and analgesical preparations made with vaseline begin to be preferred now. When the region permits it, warm baths give the best results, especially in the treatment of phlegmons of the extremities.

The systematic use of vesicating agents to accelerate the formation of a pyogenic group is an essentially veterinary measure. These agents excite the inflammation, accelerate the purulent degeneration of the tissue ; and the time when the abscess is ready to be opened, as well as that when the animal can be returned to work, is shortened.

The abcess is formed ; evident fluctuation proves it. Must it be opened immediately in all cases, or must one wait for its spontaneous opening ? Superficial abscesses, it has been advised, should be left to themselves, and in general, those whose pus may easily progress towards the skin. But this waiting has its inconveniences ; it delays recovery, carries with it a cutaneous necrosis more or less extensive, and is not free from serious dangers. Abscesses formed in the neighborhood of articulations or of tendinous sheaths may open in those cavities ; those of prepectoral glands and of the thoracic walls, in the pleura ; those of the abdominal walls, in the peritoneum. Our publications contain numerous examples of fatal accidents thus produced. Therefore, at present, the puncture of an abscess is the absolute rule.

But at what time must it be made? Generally, one should wait until the abscess is ripe. If the puncture is made when the pus is not yet entirely gathered, secondary centers may form in the inflamed zone and impose other interferences.

Numerous cases are observed, however, where the veterinarian is obliged to make the premature opening of purulent collections. When these are deeply situated, under aponeurotic fasciæ or in the neighborhood of a splanchnic cavity, of a synovial or tendinous sheath, or close to a large blood vessel, a bone, a tendon, a ligamentous cord or the fibro-cartilages of the foot, then they must be opened at once, if serious complications are to be avoided. The attractive theory of the constant tendency of pus to progress towards the tegumentary surfaces has seen its days. Examples are not rare of inflammations of the great serous membranes, of articulations, or of necrosis of organs with dull nutrition, induced by abscesses, the lancing of which had been too long delayed Thus, salivary, stercoral and urinary abscesses, where numerous bacteriæ will unite to bring on gangrenous or septic accidents, should be lanced at once. Also, purulent collections, in regions where they may interfere with the execution of important functions, must be opened as soon as they are recognized by sure signs. In this place, we may mention especially the sub-parotid abscesses which interfere with deglutition or respiration; those developed in the pelvis, which compress the rectum; those of the scrotal region, which may close up the sheath, prevent erection and interfere with micturation. In case of the horse, the same rule is to be observed for abcesses of the digital region, and for purulent gatherings under the hoof: the former have at times a rapid development; under the cutaneous chorion, which is very resisting, the pus spreads, gives rise to excessive pains, macerates the tendons, fibro-cartilages, and the bones, and sometimes reaches one of the phalangeal joints; the latter, unable to make their way through the horny covering, rapidly separate it from its tegumentary membrane underneath, and, before escaping at the coronet, produce in the tissues of the foot most serious disorders. At this point, we may understand that phlegmons vary as to gravity, and spread more or less rapidly, according to the microbic species which has caused them. Ordinarily, those originating from streptococci are more diffused and affect more the lymphatics than those due to staphylococci.

Abscesses may be opened with the *bistoury*, *trocar*, or with the *cautery*.

The *straight bistoury* is most commonly used to lance abscesses. The sharp edge of the instrument should be turned upwards or downwards, as the case may be; the thumb and index, resting on the sides of the blade, more or less close to the point, according to the depth of the cavity to be opened, should limit the introduction of the blade. A narrow incision is sufficient for superficial abscesses; if they are large,

a free cut is required. For some deep abscesses, especially in the regions where organs exist which must be respected, the tissues should be divided layer by layer; in some cases, it is wise, where once the skin is cut, to lay the bistoury aside and divide the tissues underneath with, he grooved director, the incision being afterwards enlarged with the scissors or a blunt blade. In general, the incision is made parallel to the muscles and to the vasculo nervous trunks of the region.

When one opens an abscess of the canon, fetlock or digital region the sharp edge of the bistoury must always be directed towards the shoulder. If it is directed towards the foot, and the animal, not sufficiently under control, or irritated by the pain, should move his leg suddenly, the tissues might be divided deeply and extensively ; and if the abscess is on the sides of the fetlock, the digital blood vessels might be opened, the ligaments or tendons cut, and the articulation opened. We have seen in this way the division of the digital artery.

There are regions where a puncture, as simple as it may appear, gives rise to serious results when it is not methodically performed. Before plunging the instrument into the abscess, one must take into consideration the exact situation of the blood vessels, and bear in mind that those may be displaced by the purulent collection. In pushing the bistoury deeply into such regions, an artery, a vein or a nerve may be wounded, and as the result, a hemorrhage difficult to control, or paralytic accidents may follow. Suppurative phlebitis has been more than once the consequence of punctures made without sufficient care.

The opening of the abscess must be made in the most dependent point, so as to allow the free exit of the pus. It is not neeessary that it should be large ; the discharge keeps it open until cicatrization is complete. The custom of introducing the finger into the cavity to break the band that may be found in it is not necessary, since in this way tissues which may serve for cicatrization are destroyed, or vascular or nervous branches torn. An examination of the cavity ought not to be made except for the sake of finding out the arrangement of its parts, or of seeing whether it contains foreign bodies, has cul-de-sacs, or contains pockets where the pus, collecting, may give rise to purulent infiltrations. When the puncture is made at the lower point, and the pus escapes as it is formed, recovery follows quickly. But if the purulent cavity is large, it is advantageous, after it has been washed with an antiseptic solution, to place in the opening a " rubber drain " with thick walls, and sufficiently large to allow the running through it of the albuminous masses, clots, or remains of necrosed tissues. This drain is fixed to the cutaneous borders of the wound by a suture of a stitch or two.

In regions where there are pockets, more or less deep, in which the pus collects, and cannot be squeezed out except by pressure below the

incision, the inflammation continues and the granulating process is delayed. There are two ways of overcoming this stagnation of the pus, namely, by a larger wound or a counter opening. If the pocket is small and below the puncture, division of the tissues is not dangerous and the wound may be enlarged without danger ; otherwise *counter openings* should be made. They are necessary in deep abscesses of the throat, neck, poll, withers, abdominal walls, or extremities ; and if interference has not been made early, wide undermining soon takes place, the bottom of which is ordinarily far below the point of the original puncture. Counter openings can be made by introducing through the incision of the abscess a curved director, which, pushed towards the bottom of the pocket, raise the walls of the abscess, which are then divided from outwards inwards. If the director is not used, the exact situation of the bottom of the pocket is made out with the finger, and at a corresponding point the skin and subcutaneous tissues are punctured from outwards inwards. A fenestrated drain is then put through this second opening and secured. Several counter openings may be required : they are made in a similar way. For drainage, tents made of oakum, disinfected horse-hair, or silk-worm gut are used, but the rubber tube is better ; the escape of the pus is easier. Injections into the purulent cavity, to wash it out, are also very advantageous.

To open the abscesses of mucous cavities a long trocar or a straight bistoury (protected by cotton or wadding wrapped round the blade within two or three centimeters of the point) are used. Some abscesses of the rectum can be opened with the index finger thrust suddenly through the rectal mucous membrane, which is thin at the zone of fluctuation. For others, are recommended a concealed bistoury, or one used for the puncture of the vagina in ovariotomy.

At one time the *cautery* was extensively used for opening abscesses. This has the advantage of giving rise only to slight hemorrhage, and does not have the danger of possible slippings of the instrument, and therefore the cutting of nerves or large blood vessels, if the animal suddenly struggles. But it will escape the blood vessels or nervous bands of the inflamed centre no better than the bistoury, if it be introduced in their tracts. If the cautery be selected, one should take a long pointed one, heated to white heat, place it upon the centre of the growth, and by a double movement of pressure and semi-rotation push it in, until a sensation of resistance overcome is perceived, which indicates that the cavity is entered. The pus sometimes escapes immediately, but sometimes not until the instrument is withdrawn.

The *trocar* has been recommended for opening deeply situated abscesses or those of regions containing large vascular branches which might be divided by the bistoury ; but, like the cautery, it does not always escape those organs, and in the zones which are called " *dan-*

gerous," especially the parotid region, one should rather prefer to the cautery or the trocar the following *modus operandi:* with the point of a straight bistoury, a simple cutaneous puncture is made in the centre of the phlegmonous tumor, a grooved director is then thrust, by its dull extremity, into the tissues until it has reached the centre of the cavity; by moving the director up and down, the tract it has made is enlarged. Then draw it out and replace it with scissors having dull points. Then when the director is removed, with their blades open and separated, lacerate the tissues without danger of injuring important organs, and, at the same time, leave a wide opening for the escape of the pus. A counter-opening is made in the same manner. This technique is superior to all others.

After the abscess is opened, and before the drain is placed, the parts should be washed with an antiseptic solution—preferably carbolic acid (3–5 %), corrosive sublimate (1 in 1000), cresyl (3–5 %), or tincture of iodine. During the days following, until the cavity has all granulated, two or three similar injections should be made through the drain tube. Of course those should be made in various quantities, according to the fetid odor of the pus and the seat of the abscess, which might suggest the possibility of infectious complications. When the discharge has a tendency to dry, the drainage tube should be taken off. Atomizations of iodoform ether, used by some practitioners, are not any more advantageous than simple antiseptic injections.

When the suppuration lasts a longer time than abscesses ordinarily require to be filled, the wound becomes fistulous, and various secondary lesions may exist. Sometimes it is because of a foreign body that must be extracted, or of an undermining where the walls have to be modified, or it is on account of a necrotic lesion which, if it will not yield to strong antiseptic solutions, must require another operation.

Septic or gangrenous phlegmons should be opened at once and treated with strong disinfecting solutions. If there are portions of necrosed tissues, they should be cut away. Continuous irrigation may also be used with advantage.

After the pyogenic membrane has been cleaned, a slight pressure to bring the walls of the sac more or less closely together, will accelerate the cicatrization. Some authors, considering the lining membrane of a warm abscess like the surfaces of a fresh wound, suggested bringing the walls close together, after the careful and complete washing of the cavity, in order to try to obtain union by first intention. This practice generally failed, although it was of advantage in reducing the dimensions of the cavity and in shortening the duration of the cicatrizations. With antisepsis, the adhesive reunion of the walls of the abscess has been attempted, after the walls have been cleaned with the curette and disinfected with a strong carbolic solution. The results obtained, how-

ever, have not been encouraging. In the generality of cases, the surfaces, thus prepared and opposed to each other, continue to suppurate. Sometimes the tissues, where the abscess has developed, remain tumefied for a long time and become indurated. The best treatment for such consecutive indurations, is cauterization with penetrating points.

The "*hemorrhagic phlegmon*" of oxen is generally produced by pricks of the goad with which they are driven; sometimes it has been observed after a violent blow, and also without any well known cause (Guittard). In some cases it is on the outside, in others it is deeply situated in muscular interstices.

It is characterized at first by a large, diffused, renitent swelling, more or less painful, which later becomes fluctuating. It is easily distinguished from serous collections and from the crepitating tumors of symptomatic anthrax.

Cold abscesses differentiate from the preceding by a weak degree of inflammatory reaction, or its absence altogether. The nature and etiology of these are no less complex than of those of an acute character. *Tuberculous abscesses*, so common in the human species, are exceptional in our domestic animals.

When multiple tumors develop rapidly and simultaneously in various regions of the body, they are not always, as often supposed, cold purulent collections. Sometimes they are true neoplasms; sub-cutaneous sarcomas may develop somewhat rapidly, and resemble cold abscesses. We have observed a remarkable case of this kind among horses.

Hard cold abscesses, frequent among horses, in regions which support the various parts of the harness (point and anterior border of the shoulder, poll, superior part of the neck, withers, girth) do not get well except by puncture. The central purulent collection in them is often of small size; and several probings may be necessary to open it. These probings are made with the straight, narrow-bladed bistoury, which is thrust deep into the tumor. As soon as the centre of the abscess is reached, if the pus exists in any quantity it escapes this way to the surface. But the white (*blanche*) puncture, which fails to bring out pus, does not necessarily mean that the abscess has no pus; often the bistoury does not reach the spot where it is, or passes alongside of it, or the pus is so thick and caseous that it has no tendency to escape through the way thus made. One need not hesitate to make new punctures, and several tracts towards the centre of the indurated mass; in most cases the purulent cavity will be reached finally. But if the probing still remains fruitless, the inflammation which it causes is not without a useful effect; the pyogenic process is quickened, and the pus, increasing in quantity, finally appears through one or another of the

openings made by the bistoury. The condition for the continuance of the inflammatory tumor is removed, and the tumor then gradually diminishes and soon disappears.

In numerous cases, it is necessary to enlarge the tract, from which the pus flows. This is done with a bistoury, guided by a director, to make a larger incision ; or by using a cautery heated to white heat, which is thrust into the tract. A tent or a rubber drain is introduced and secured in the wound when the enlargement of the incision has been made with the bistoury. The drain, which insures the flow of the pus and allows antiseptic or irritating injections, as the case may demand, into the wound, is always preferable to a tent introduced into the tract of the abscess.

Many practitioners use the cautery. It is not only dipped into the indurated mass or introduced into the wound made by the puncture to enlarge it, but it is also used to make a certain number of deep points, to stimulate the resorption of the newly formed tissue. Often a vesicating preparation (blister, mercury ointment, or biodide of mercury ointment) is applied all over the surface of the tumor to complete the operation and the action of the cauterization. The same means may be used when the exploring punctures have failed to reach the abscesses.

When the cold abscess is in a region full of important organs (blood vessels, nerves, and synovial membranes), the bistoury and the cautery are not to be introduced deeply. The directions given in the chapter on warm abscesses must be followed for these. Puncture with the grooved director, after incision of the skin, is the best mode.

Soft cold abscesses should be opened in their most dependent part, drained and irrigated afterwards with strong antiseptic solutions.

During distemper, voluminous cold abscesses may be seen appearing in various regions ; they rapidly become fluctuating and ordinarily contain a large quantity of pus. Their treatment does not differ from that of ordinary abscesses : puncture, enlargement of the wound or counter opening, drainage and frequent antiseptic injections.

Local secondary purulent collections, including *congestive abscesses*, require the same care, besides attending to the treatment suggested by their various causes (necrosis, caries, phlebitis, inflammation of synovial membranes, wounds of the œsophagus, of the rumen or of the urethra). Multiple abscesses of the inferior regions of the extremities are sometimes accompanied by swelling of the leg, which may end in elephantiac fibroma, when the rapid resolution of the phlegmasia is not obtained by antiseptic balneation.

In cases of cold abscesses due to a diathesic condition (lymphatism, rheumatism or anæmia) a general medication should be resorted to (good hygiene, strengthening food, arsenical and iodous preparations).

The treatment of some dyscrasic abscesses (glanders) calls for no attention. Animals which suffer from these should be killed.

III.

GANGRENE.

Bacteriological discoveries have caused gangrene to be divided into the *aseptic* on the one hand and the *septic* or *infectious* on the other. We shall study the latter with the complications of the various traumatisms. For the present we shall only consider microbian mortifications and *circumscribed* sphacelus, in the genesis of which bacteria have played a more or less active part.

On account of the multiplicity of the causes and of the complex pathogeny of those gangrenes it can easily be understood that preventive measures vary greatly according to circumstances. Let us observe, however, that the *gangrenes of nervous origin* (brought on by neuritis or by lesions of the centres), those of a *theromatous* and *diabetic*, as well as those following *thrombosis* and *embolism*, are very rare in animals.

We shall first set forth the treatment of gangrenes, considered from a general point of view; afterwards we shall examine the therapeutics of the two principal forms of sphacel of the soft tissues.

The *prophylaxis* of gangrene includes means deducted from the numerous etiological conditions likely to produce it. When once the influence of these conditions is attenuated or annihilated, one must, by appropriate treatment, stop the processes which may bring on mortification of the tissues. Among working animals, cutaneous gangrene of the regions injured by the harness can be prevented, by seeing that they are in good condition, and are supple and exactly adapted to the parts with which they are to come in contact. In the case of disabled animals, which, on account of pain, are obliged to keep a reclining position for a number of days, the same object will be reached by providing them with a thick bed, free from injurious foreign substances, or by obliging them to rest first upon one side of the body, then on the other (by turning them over). One should bear in mind that blisters and caustics, applied in excess, have at times a violent action, which, extending beyond the desired effect, bring on the mortification of the tegument and of the first sub-cutaneous layers; and also that the cautery, which we use so frequently, easily produces similar results, if it is applied in violation of the established rules, is put on too hot, or left too long in contact with the skin. In cases where the extremities have been injured, where the permanent application of a bandage or of a more or less compressive apparatus is required, sphacel by arrest of the circulation may be avoided either by using only methodical and moderate pressure upon the injured region, or by spreading the apparatus over the entire extremity below the seat of the wound, beginning the application of the

bandage at the digital region. In cases of very severe inflammation of the skin and sub-cutaneous tissues, one should endeavor to keep up a sufficient circulation, and the changes necessary for the physiological functions of the cellular elements; and should also provide against deep disorders and alterations incompatible with the presence of life, by actively overcoming the phlegmasic phenomena, and above all by using the means which antisepsis gives us. Deep scarifications, division of the aponeuroses pressing upon the tumefied structures, often produce remarkable results. In cases of violent contusions or of wounds from extensive bruising, having a wide ischemic zone, damp compresses or warm antiseptic baths are to be recommended: the innervation will then return, the collateral circulation will become more active, the anatomical elements, for a moment in danger, will by degrees recover their original activity; for the wounds of contusion, the extensive mortification threatened will be reduced to its minimum, carrying only a few mortified shreds from the edges of the traumatism. How to prevent several gangrenes of toxic origin, especially that due to ergotism, has been known since the day when facts established the intimate connection existing between the ingestion of food altered by toxic products and the appearance of gangrenous disorders in animals which ate this food. The only way is to stop its use immediately, change for some other food, or make the stock pasture somewhere else. But economical reasons, which dominate all questions relating to the keeping and preservation of stock, would often have rendered the execution of these prophylactic measures very difficult if gangrene by ergot had not become so rare in most of the countries of Europe. As far as necrotic accidents are concerned which may result from central or peripheral nervous centres, —diabetes, thrombosis and embolism,—there is no efficacious prophylaxy against these.

Properly speaking, there is no *curative treatment* of gangrene. One cannot, indeed, expect to return life to necrosed tissues. Several rules ought to be observed, however, to hasten the slough of the dead parts and assist the work of repair.

To limit the extension of the gangrene, assist the elimination of the eschars, and hasten the cicatrization of the wounds remaining; such are the principal rules of interference.

When death has taken place more or less extensively in the tissues, the most important thing, if one wishes to confine the destruction, is to arrest at once the action of the causes which have produced it. Gangrene of a cutaneous spot, brought on by compression, is prevented from spreading, both in width and in depth, by putting a limit to the compression. By an energetic interference in the case of gangrene from severe phlegmasia one may avoid the formation of new sloughs within

the neighborhood of the centre of mortification. Though, let us remark, that if infectious gangrenes are ordinarily rapid in their progress, ordinary sphacels have but little tendency to radiate. The bistoury or the cautery are used only to permit the discharge of eschars infiltrated with liquids or the introduction of antiseptic preparations into the network of the tissues in order to prevent putrefaction. In the great majority of cases, one uses either repeated carbolic or corrosive sublimate lotions upon the dead tissues and the surrounding parts, or continual bathing in those solutions. At this stage, the disorders produced by gangrene can be determined. There are cases where the sphacel has extended so much in width and in depth, and has made such ravages, that recovery of the patient cannot be expected. Gangrenes due to the obliteration of a vascular trunk demand the immediate killing of the animal. Those which involve only superficial layers—skin and tissues underneath—are sometimes serious in their consequences, when they are in the neighborhood of joints or tendons; they often are complicated with synovitis, arthritis with or without necrotic accidents and afterward cicatricial retractions. One must foresee these complications, avoid useless expense, and as quickly as possible come to a conclusion as to the future recovery of the patient.

As soon as gangrene has ended its work the surrounding parts become inflamed, and by their reaction of the mortified territory is settled in its boundaries. This is a natural and constant phenomenon, which is accomplished more or less rapidly according to the extent of the slough and the vitality of the parts involved. If the separation is slow, it can be hastened by exciting reactionary phlegmasia with irritants (blisters, or any cantharidal preparations, etc.); if, on the contrary, the elimination of the gangrenous masses is accompanied by an intense inflammatory reaction, and the surrounding tissues are much swollen, then warm lotions, often repeated, of antiseptic solutions, pure or mixed with narcotic substances, according to the degree of the pain, should be employed. If the pain is excessive, preparations of cocaine are useful.

As the boundary fissure increases, the pus increases; if its escape is prevented, or if it accumulates in the dividing trench, frequent disinfecting washes, or the use of absorbing or antiseptic powders is good, as well as the making of counter openings and the placing of drains. The eschars, macerated by the pus, infested with numerous microorganisms, putrefy rapidly, and spread over the wound liquids with repulsive odor, favoring infections and poisons the organism. In such cases, continued irrigation is beneficial. To it as well as to the antiseptics one must also have recourse when there are important organs deeper down which may yet be healthy. Often the greater part of the slough is excised or removed by actual cauterization. This last mode is preferable to the use of potential caustics, which used to be placed on the

eschar, and which, uniting with it, rendered it imputrescible. If caustics are deposited in small quantities over large and thick eschars, they are harmless, but their action may spread and corrode healthy structures. It has been wrongly said that they have an especial affinity for diseased tissues, and that, if they are used with care, their destroying action remains limited to gangrenous soft parts, as to suppurating or carious bony tissues. As Reclus remarks, the legend of the "intelligent caustics" is no longer current. When the sphacel is extensive, instead of destroying the whole of the eschar, one may make with the red iron scarifications close to one another, which having partly burnt, are afterwards filled with disinfecting powders or liquids.

When the process of elimination is completed, the wound resulting from the slough of the mortified tissues is at times simple and covered with a layer of active, healthy granulations, and requires the same treatment as solutions of continuity with loss of substance; at other times it is complicated with necrotic alterations (aponeurosis, tendon, ligament, bone), or with lesions, involving large blood vessels, and with inflammation of a synovial or of a splanchnic serous membrane.

The *general treatment* is important only in gangrenes of a dyscratic or infectious origin. Narcotics should be used only in cases where the pain is great. Antiseptics are always useful when the sphacels are extensive and threaten infectious accidents. Local disinfection is always far more important than any of the various internal medications recommended.

There are special rules for the treatment of gangrene according to the form it assumes.

Dry gangrene, which we meet most frequently in animals, whether due to the compressive action of the harness or to continued decubitus, are generally accompanied by sharp pains while the process of sloughing goes on. According to their seat, they are treated sometimes with emollient or narcotic preparations of vaseline, or most commonly with vesicating agents which are better to quicken the slough of the eschars. These, generally dried up and parchment like, putrefy only on their borders, where they are macerated in pus; they do not, as in moist gangrene, expose the parts to infectious accidents; there is no objection to leaving them entire and intact until they drop. Partial excision, however, is advisable for the extensive stickfasts of the withers and of the neck, which have such an offensive odor. If the suppuration is abundant, free disinfecting washings are to be insisted upon. In no case are the scabs to be torn away, no more than other eschars resulting from a dry mortification; doing so might produce secondary necrotic lesions in the cervical or dorsal regions or in the lower part of the extremities; and in the neighborhood of a joint, it might be followed

by the opening of the synovial sac. In cases where the fissure of separation is very deep, the pus abundant, and its escape difficult, several incisions may be made to relieve the difficulty.

With *moist gangrene*, as with the preceding, the work of defining and eliminating the eschar must be trusted to nature. Interference here should also be limited ; assist the work of demarcation and prevent with disinfections the accidents likely to follow the putrefaction of dead tissues. The wound should be frequently washed with antiseptic solutions (strong preparations of carbolic acid, creolin, chloride of zinc or of lime, or of permanganate of potassium) ; thus, the odor from the putrefying tissues will be much less marked. The powders of coal or of coal tar, thrown upon the mortified parts and into the fissure of the slough, will also diminish this odor very much and absorb the gas escaping from the decomposing tissues. As soon as the eschar is loose, its superficial layers can be cauterized, or excised with the bistoury or the scissors, being careful not to touch the sound structure. If pain is severe, the inflamed tissues should be covered with boricated or iodoformed vaseline to which cocaine has been added. The antiseptic washes should be applied frequently until the wound is covered over its entire surface with granulations. Incisions along the edges and counter openings are more dangerous in this than in dry gangrene ; they would better not be made unless they are urgent, and then they must be made with the actual cautery.

Diabetic gangrene (dog) receives the same local treatment as the moist form. Besides this, an antidiabetic regimen should be instituted (meat, milk, exercise), with the internal administration of antipyrine, alcalines, and arsenic.

IV.

ULCERS.

In a general way, all suppurating wounds, without tendency to cicatrization, deserve the name of ulcers. Glanders, tuberculosis, carcinosis, and scurvy give rise to *symptomatic ulcers*, simple accidents of the infections to which they are related.

The group of *idiopathic ulcers* has been considerably reduced by the progress of pathological anatomy. It only contains now ulcers from " unknown causes," and seems condemned to disappear soon from the nosological list. These ulcers are the consequence of arterial, venous or nervous lesions, which reduce locally the resistance of the tissues and seem to be under the influence of diathetic states, especially of arthritism. They are less frequent in animals than in men.

From the surgical point of view, we will recognize : 1. *Inflammatory*

ulcers, which are the seat of phlegmasic phenomena, more or less severe ; 2. *Fungous ulcers*, characterized by exuberant granulations ; 3. *Atomic ulcers*, without vital reaction of the affected tissues ; 4. *Callous ulcers*, with indurated borders, cartilage-like, due to a chronic inflammation of long duration ; 5. *Phagedenic ulcers*, which spread rapidly by a quick and continued mortification of the borders.

A great number of ulcers, especially those which result from a chronic simple phlegmasia or from repeated irritations, get well rapidly ; for these, all that is required is to place the diseased region under favorable conditions, protect it from the influences which have given rise to it, and continue the same course. Others, notwithstanding the taking of energetic measures, require a long time to heal. According to the case, antiseptics, excitants, caustics, the bistoury or the red iron are to be used.

Painful, erethistic inflammatory ulcers must be treated with sprayings or warm antiseptic baths, and cocained or iodoformed vaseline applications. Wadded dressings, covered with an elastic band to apply moderate pressure, are often beneficial.

Against *fungous ulcers*, astringents may do good. But at times the granulations must be destroyed with caustics (nitrate of silver, sulphate of copper, chromic acid or permanganate of potassium), with the cautery, or be excised with scissors, the bistoury or the curette. Antisepsis and elastic compressions do the rest.

Atomic ulcers are treated with light and repeated cauterization of nitrate of silver or the hot iron, then with antiseptic dressings.

To bring a more active vascularity to *callous ulcers*, and keep in them the necessary hyperæmia for granulating, one must use damp heat, alone or combined with elastic pressure. There are cases where recovery is obtained only by destruction of the edges of the wound, with the bistoury, caustics or the actual cautery.

Phagedenic ulcers require a quick interference. They are treated with the solutions of carbolic acid, creolin, or chloride of zinc, used in lotions or in baths, or by iodoform dressing, changed often. Should these be powerless to stop the invading march of the ulcer, the red iron has to be used.

The therapeutics of *Symptomatic ulcers* is united with that of the affection to which they belong. In some cases, a local treatment is sufficient ; in others it is necessary to add to it an internal medication (tonics, alkalines, arsenic.)

V.

FISTULÆ.

Modern classifications of fistulæ are based upon the etiology, pathogeny and anatomo-pathological characters of these lesions. We have congenital and *pathological fistulæ*, also *fistulæ from want of cicatrization* and *those from defective cicatrization.* The most common congenital fistulæ are those of the umbilicus, the urethra, and those which establish a communication between the rectum or the bladder and the vagina. *Pathological fistulæ* include numerous varieties. We find the *incomplete*, *blind*, or *non-communicating*, and the *complete* or *communicating* fistulæ. Blind fistulæ are called *idiopathic* when they follow abscesses; *symptomatic* when they result from other lesions; they are *externally blind* when they open on the skin; *internally blind* when on the mucous tegument. Communicating fistulæ include: 1. *Serous* fistulæ, which open deep down in one of the large visceral cavities, in an articular or tendinous synovial sac, or in a natural or accidental subcutaneous bursa; 2. *Mucous* fistulæ, which open in a reservoir or in a excretory canal. Generally, complete fistulæ are *cutaneous* and *mucous*; one of their openings is on the skin, the other on a mucous membrane; they may be *bi-mucous* or *bi-cutaneous* when they have two openings on those membranes.

The therapeutics of fistulæ include numerous methods or means, which have their special regulations. It is plain that lesions, so various as to nature and origin, will require different kinds of treatment. Symptomatic fistulæ do not demand the same care as idiopathic fistulæ; with fistulæ which opens in serous cavities, it would be dangerous to interfere as it is ordinarily done with those which open on a mucous membrane or in an excretory canal; many of the latter require a special interference.

Idiopathic purulent fistulæ, often kept up by the peculiar condition of their walls, by the atony of their granulating layer, sometimes by the sinuosity of their course, by the existence of subcutaneous or intramuscular undermining, or by the excessive mobility of the organic layers of the region where they exist, do not resist a local energetic treatment. One may recognize the nature of the persistence of the fistulous tract by the more or less marked tumefaction of the region, the quantity and the quality of the pus, and by exploring the tract. If it be due to an undermining and kept up by frequent motions of the part, one may, after thoroughly washing the cavity, attempt a cure by pressure and immobilization of the region. But often the undermining ex-

tends far beyond the fistulous tract, or perhaps pressure cannot be applied. In such cases, the rule is to make a counter-opening in the most dependent part so as to allow and complete the escape of the pus through a drain tube. Whether there is undermining or not, if the fistulous tract is old, organized, and lined with an epithelial layer, cicatrization cannot take place without destroying this superficial covering and stimulating an active granulating process. Injections, the seton and cauterization fulfil all these requirements. A great number of therapeutic agents have been used in injections to stimulate the granulation of fistulæ; among them metallic sulphates, tinctures and antiseptics in concentrated solutions. The most desirable of these are the Villate solution, the tincture of iodine, the alcoholic solution of corrosive sublimate, the aqueous solution of chloride of zinc (8–10 %) and of carbolic acid (5%). If cicatrization is slow, it is wise to change the injections. In cases where these fail, solid caustics may be introduced into the fistulæ: minium troches, pencils of nitrate of silver, paste of sublimate or of chloride of zinc. With obstinate bicutaneous fistulæ, the introduction into the tract of tents or small setons, impregnated with irrigating caustic or vesicating preparations (Villate solution, tincture of iodine, spirits of turpentine, blister ointment, basilicon, or iodide of mercury ointment), is good practise; when it is necessary to introduce several tents, they should be made small, so as to not interfere with the granulations. Cauterization of the tract of old fistulæ with the hot iron is an old, severe, but certain mode of treatment. It is done with a blunt probe or a metallic wire of small dimensions; the narrow and blunt point of the zoocautery is very good for short tracts. In some cases, it is advantageous to have recourse to incision, and curetting of the tract. Incision assists cicatrization of fistulæ with several tracts. The callosities existing on the walls of old fistulous canals generally require to be removed with the bistoury or with the curette. Some of these fistulæ require special operations; for instance, that which is present in cases of keraphyllocele, is relieved only by the extirpation of the horny growth.

The treatment of *symptomatic fistulæ* depends on their causes, and the conditions of their presence. Some are due to the presence of a foreign body or a necrosed, loose piece of bone; they are recognized by the pus which flows from them, not very abundant, or unpleasant in nature. They heal rapidly after that which causes them is removed. To do this, one has only to enlarge the size of the tract, take hold of the irritating object and extract it. Most of these fistulæ are the expression of a necrotic lesion involving a bone, a cartilage, a tendon, a ligament or an aponeurosis; they secrete abundantly a grayish, watery pus, often grumous and carrying small pieces of necrosed structure. Generally, the seat of the wound, the extent of the indura-

tion, and the probing allow one to detect the exact nature of the existing lesion. The treatment varies according to cases. At times, simply a larger incision, and escharotic injections are all that is required; at others, to stimulate the action of the caustics and permit the free escape of the pus, one or several counter-openings have to be made, and drainage tubes inserted; at other times, if the necrotic lesion is superficial, especially in cases of a bony alteration, it is better to dry off immediately the source of the suppuration by removal of the mortified part. Care should be taken that the pus be not in contact with tissues with sluggish nutrition, since they offer an easy prey to pyogenic microbes. Cauterization of the diseased center, a method borrowed from old hippiatria and brought down to our own times, is far inferior to immediate extirpation; it leaves an eschar, which sloughs off slowly; and in fibrous tissues a new focus of necrosis may be the result of the extensive suppuration that follows. In horses and in cattle, sometimes, the product of the secretion of fistulous walls dries and forms in the tract a cylindrical, hollow, foreign body, which keeps up the suppuration. We have just seen a remarkable case of this nature in an animal suffering from an old fistula of the flank.

Of serous fistulæ, some get well quite rapidly by the division of the tract and by simple antiseptic injections; those of serous bursæ and small tendinous sheaths, belong to the same group. But fistulous tracts which open into large tendinous or articular synovial membranes are very serious in animals, on account of the difficulty of thoroughly disinfecting those cavities: in former days, injections of Œgyptiacum, a direct cauterization of the walls with a red iron or with nitrate of silver, were recommended for these. To-day antiseptic treatment is preferred. (See *Articular Wounds and Arthritis.*) Fistulæ of the large serous membranes are very rare; they are observed only where the traumatisms which precede them have given rise to a circumscribed phlegmasia of these membranes and to the formation of adhesions which bound the suppurating serous territory. Antiseptics are used for these cases. Very recently, a strong carbolic acid solution has given us rapid recovery in a case of vagino-peritoneal fistula following an operation of ovariotomy on a mare.

We shall be concise in speaking of the treatment of mucous fistulæ, and will return to it when we study these lesions in particular. Of these fistulæ, those which are kept up intentionally by a foreign body have a well-marked tendency to cicatrization. The muco-cutaneous fistulæ of the sinuses, following trephining, close in a few days by the removal of the corks or drains which keep them open; those of the trachea heal in the same way when the tube of tracheotomy is taken away. If those that are due to dental caries or to suppurative alveolitis require a long time to heal after the extraction of the diseased tooth, it is due to the

slow process of the phenomena of the existing osteitis and to the accumulation of food and saliva in the alveolar cavity. Some œsophageal fistulæ are obstinate and require surgical interference. As to the recto-vaginal and the vesico-vaginal fistulæ, attempts so far made with animals to bring about cicatrization have only proved unsuccessful.

There are fistulæ of excretory canals which naturally have a tendency towards cicatrization: those of the perineum after urethrotomy, for instance. But almost all of them require a special treatment. There are three principal methods to be used: 1. Restore the normal course of the flow; 2. Create an artificial one; 3. Dry its source.

If the fistula is recent, one may resort to the first method; application on the fistulous orifice of a closing bandage, vesicating frictions, light and repeated cauterization of its edges, dilatation of the canal by injections or by repeated uses of the sounds and the like. Occlusion, vesication, and suture have often been used for recent salivary or urethral fistulæ. The second method is applicable only to a small number of cases; it is especially advised for a fistula of steno duct, open on the cheek. To make a new way and dry the cutaneous fistula, the deep layers of the cheek, including the buccal membrane, are perforated on a level with the wound, which is then closed by suture or a pitch plaster; the saliva escapes then into the mouth and transforms the newly-made tract into a fistula. Success is still more certain if the new tract is drained while the old one is obliterated. The last method brings on recovery in cases of fistula by producing the atrophy of the gland. For certain salivary fistulæ, irritating injections made in the parotid gland and the ligature of the excretory duct have been successfully employed.

Purulent, stercoral, and vesical fistulæ are quickly followed by erythema of the parts soiled by the substances escaping from them. In their neighborhood, the skin ought to be washed several times a day with a weak, tepid, antiseptic solution, and covered with boricated vaseline or glycerine.

For some subjects, it may be useful to institute an appropriate general treatment. Good food and tonics are always advantageous for debilitated animals, weakened by an abundant suppuration of long standing. For certain fistulæ of the dog, an internal medication is advised (Fowler solution, Cod Liver Oil).

VI.

FOREIGN BODIES.

Among the foreign bodies to be found in animals, some are formed in the organism under the influence of morbid processes (splinters, sequestra, calculi, pedunculated tumors of the peritoneum), but most of them have come from outside, having penetrated the organism either

through natural passages or through the skin or a mucous membrane. The last are those which we shall specially consider.

The phenomena produced by foreign bodies vary considerably according to the degree of tolerance of the tissues with which they are in contact, and especially according to their more or less irritating properties, and their septic or aseptic constitution.

The digestive canal is the principal way for the introduction of foreign bodies, and its mucous membrane is one of the most hospitable. Among the substances which enter the mouth, some stay in it, implant themselves on the gums, the cheeks, or the tongue, and give rise to abscesses (Huchne, Dehaye). Others perforate the walls of that cavity: in an abscess of the hollow of the right eye, Lapoussée found a mass of beards of wheat; in a similar spot, Klintmann saw small pieces of straw. The nervous centers have sometimes been reached by those emigrating substances which run through the walls of the mouth and of the pharynx: at the *post mortem* examination of a horse, Rodez and Renard found the cranium perforated by a stalk of grass; in a pig, Durrechou observed an intra-cranial abscess caused by a needle; at the autopsy of a dog having died from meningo-encephalitis, we have seen, with the lesions of that disease, a deep, suppurative otitis due to a metallic piece, which, after perforating the soft palate, had entered the Eustachian tube. Larvæ of œstré can produce similar disorders. (Megnin).

Most foreign bodies introduced into the mouth pass into the pharynx and the œsophagus; sometimes they remain there: Métivet treated a horse whose throat was closed by a piece of wood; the œsophageal obstruction of cattle is well known. Some of these bodies drop into the trachea (Degive, Bournay). Those which reach the stomach have varied fortune. They may remain there without producing visible trouble: this fact, very ordinary in ruminants, is known in all species of animals: at the *post mortem* examination of a mare which had died suddenly, Garde found in the stomach seventy-five little stones weighing altogether 4 kilogrammes (8 pounds); Nichoux found in a dog a five-franc piece and one two-cent piece, which had remained in the stomach twelve years without apparent trouble to the dog; in an animal of the same species, we found two tops which had been in the stomach eleven months. Some of these bodies give rise to dyspeptic symptoms: in ruminants, to meteorizations; in dogs, vomiting followed by anorexia and loss of flesh. Ordinarily the dog succeeds in throwing up the foreign body accidentally swallowed. Weber has related the case of a dog thus rendering one morning "a gold piece of twenty francs and two silver fifty centimes." When the substance swallowed is not too big, it may pass through the pylorus, travel through the intestines and be eliminated: the horse of our Belgian confrère André,

passed a curb-chain which he had swallowed; the dog of which a report was made by Leblanc, passed a stone of large dimensions; that of Mathis, after violent fits of colic expelled "the cork of a champagne bottle." When the dimensions are too great, the foreign body is arrested, and may give rise to rabid symptoms; the phenomena, however, of deep depression generally predominate. If the body become encysted, it soon produces severe inflammation and sphacel of the intestinal walls, if it is not removed by laparotomy. (Noirit, Felizet, Degive, Fröhner).*

Sharp bodies, when introduced into the digestive canal, end by implanting themselves in its walls and pass through them more or less rapidly. Passing through the œsophagus, they may injure the anterior aorta (Olivier) or the posterior (Daigney), give rise to an aneurism (Olivier), or to a fatal hemorrhage. In ruminants, they pass through the rumen or the reticulum, and, according to the direction they take, reach the liver, the spleen, the abdominal walls, the diaphragm, heart, lungs, muscles of the shoulder or of the arm, the vertebral column, and even the spinal cord. A foreign body is the common cause of traumatic pericarditis of cattle. Guillaumin, Robinson, Aubry, Mottet, Lanusse, Berger, Bru, Morot, Lucet have recorded abscesses of the thorax or of the abdomen, due to the presence of foreign bodies which have been swallowed. The cow which served Mottet for a subject of observation swallowed two long needles; the eighteenth day, the point of one appeared under the skin of the middle of the right flank; a week later, the other showed itself near the last left rib; the animal seemed scarcely disturbed by them and the wounds healed rapidly. Rupture of the intestine (Clerc and Jacotin), abscesses of the omentum (Salle), or of the liver (Thierry), and peritonitis, also represent possible complications of foreign bodies passing through the digestive canal. An autopsy of a horse, made by Salle, revealed an epiploic tumor; and in the center was a cavity filled with pus, in which floated a "string 25 centimeters long."

The *vaginal mucous* membrane possesses a certain amount of tolerance; the mucous membranes of the *uterus*, *bladder* and *urethra* are more irritable; metallic substances, however, introduced into the *uterus* to overcome nymphomany (Éloire) are perfectly supported. As to the *ocular* and *respiratory* mucous membranes, they always react strongly

* From records of the Hospital Department of the American Veterinary College, Drs. Huehne, and Morrison report the case of a dog in which the foreign body was imbedded into the pyloric opening of the stomach. It consisted of a ball of brown paper tightly rolled. (Americ. Veter. Review. Vol. 13—p. 175). (T)

At the *post mortem* examination of a cat that had been ailing for some time without manifest symptoms, a piece of the cob of an ear of corn was found imbedded into the pyloric opening of the stomach by the translator.

against irritating contacts. At the *post mortem* examination of a dog affected with severe wheezing, and short and repeated coughs, Bournay found under the vocal cords "a small, oval, flattened piece of gravel, which completely closed the trachea."

Cellular, fibrous, muscular, and *glandular tissues* react little against the contact of foreign aseptic bodies. Frequently shots, bullets and other bodies of some size produce only the phenomena of encystment. Projectiles of small caliber may thus remain in the tissues for years without producing any trouble; then again they may give rise to accidents after remaining innocuous for some time. A ball encysted in the hand of the man wounded at Waterloo, mentioned by Harland, after fifty-nine years of perfect tolerance, gave rise to disorders (Terrier). Infected inorganic substances (wood, leather, etc.) ordinarily bring on severe inflammation.

Bones will stand metallic substances of small size without perceptible reaction. Encystment, however, is more commonly observed in long than in flat or short bones; and in the former, more in the epiphysis than in the diaphysis. When there are other bodies than projectiles or metallic points, then often the bone becomes inflamed, suppurates, and serious consequences are to be feared.

The disturbances produced in *viscera* by foreign bodies depend also on the properties of the bodies and the degree of irritability of these organs. If certain regions of the brain (hemispheres, white commissural portions) are remarkable for their tolerance, in general the encephalon, the marrow, and the nerves do not support the contact of foreign bodies. The patients of Renard and of Durrechou died from a cerebral abscess. Encystment is possible in the spleen and the liver; it is quite frequent in the lung, where, as in all viscera, one may, however, observe primitive or secondary accidents very serious.

Serous membranes possess a remarkable tolerance towards bodies formed spontaneously in their cavity (intra-articular movable bodies, pedunculated tumors of the peritoneum); they support equally well the contact of aseptic foreign bodies, but they are extremely susceptible to those that are soiled, and more or less septic; and the action of the latter invariably gives rise to an inflammation rapidly generalized. Although the peritoneum may ordinarily be run through by free needles without accident, it becomes the seat of an infectious diffused phlegmasia in contact with a needle carrying a soiled thread. There is the same order of phenomena and the same differences for wounding bodies (septic or aseptic) which, after divisions of the abdominal or thoracic walls, reach the peritoneum or the pleura. Kolb has found in the right ventricle of the heart of a cow, a lancet blade three and a half centimeters long by two in width, which had become loose during a bleeding of the jugular and had been carried away by the current of the blood.

This blade had remained in the heart without giving rise to the slightest trouble. Articular or tendinous synovial membranes behave like the serous membranes of splanchnic cavities.

The tolerance of the *media of the eye* is also especially related to the aseptic or infecting condition of the body which has penetrated them; the iris, vitreous humor, and the retina, however, are more susceptible than the crystalline lens and the serous membrane of the anterior chamber.

In the *foot* of the horse, foreign bodies produce, almost always rapidly, serious troubles, on account of the complex structure of that organ, of the ordinarily infectious character of the traumatism, and of the compression to which the injured parts are submitted.

Animate foreign bodies produce very different effects, according to the species, the number, their properties and the tissues upon which they are fixed. How many intermediate degrees can be observed between the weak reaction of the stomachal mucous membrane of the horse from œstri, and the intolerance of the nervous centers towards the parasites which are carried to them by the blood.

To *liquid foreign bodies* the susceptibility of the organs is no less variable. No serious troubles result, ordinarily, from the introduction of serosity poured into closed traumatic lesions. Liquids, aseptic and not toxic, injected under the skin, into muscles, serous membranes or blood-vessels, are also well supported. But the tissues are very susceptible to the contact of some organic liquids obtained from their natural canals (urine, bile, saliva). The escape of bile, or of urine, into the peritoneum is often fatal. Medicamental solutions injected without sufficient aseptic care, ordinarily bring on suppuration or other infectious accidents. The contents of hydatic cysts and of all morbid secretions, generally speaking, are badly tolerated.

Gases, considered as foreign bodies, offer little interest. All are harmless, except those that possess toxic properties, and are tolerated by the tissues without trouble. The benignity of traumatic emphysema, even when it is more or less generalized, is well known. Phenomena of intolerance are observed only when gases hold infectious agents in suspension.

The therapeutics of foreign bodies presents very different requirements, according to their nature, their size and their aseptic or infectious state. The preceding considerations show the relative innocuity of metallic bodies compared with organic substances, and the remarkable tolerance of the tissues for the former, when they are small and aseptic. The organism does not try to get rid of them; it only defends itself against contact with them; it isolates them with a circular neoformation resulting in an encysting membrane. No immediate interference is necessary for those, unless they are so nearly on the surface that their

extraction offers no serious difficulty. Leave the work of encystment and watch the progress of the changes. It is in conformity to this rule, that little projectiles and other metallic bodies are left in the tissues. Penetrating wounds should not be explored with dirty instruments or fingers. Cut the hair round the traumatism, disinfect it with free antiseptic irrigation, cover it with iodoform, collodion, and, if possible, with a wadding dressing. Such are the regulations to follow. Extraction is advised only for projectiles immediately under the surface of the skin, and requiring only slight incision. If the foreign bodies are protruding from the surface of the skin, they must be removed immediately with all necessary care, and the wound must be treated like those resulting from punctures. (See *Gun Shot Wounds* and *Wounds* by *Pricking Instruments.*)

More or less soiled foreign bodies, introduced into any region and situated superficially, are extracted with forceps after the disinfection and division of the tract which they have made. The interference is the same for similar bodies lodged deeply in a muscular region—neck, shoulder, croup, or thigh—where only important blood-vessels and nerves are to be avoided. Abscesses produced by foreign bodies which have run through the mucous membrane of the mouth, pharynx, œsophagus, stomach, or intestines, and have migrated into the tissues, do require special attention. Whether situated on the head, neck, thorax, or abdomen, as soon as fluctuation is manifest, they must be punctured, the injuring body extracted, and antiseptics applied. For those which appear on the thoracic or abdominal walls, the diagnosis is sometimes difficult.

Generally, the cicatrization of the tract made by the foreign body takes place quickly. It may, however, leave a fistula. After extracting a pair of scissors from an abdominal abscess in a steer, Berger found that the wound extended to the rumen (see *Intestinal Fistulæ*). Some fistulæ, not in communication with a mucous membrane, may be kept discharging by the presence of a second foreign body held in the tissues, or by a piece of the first.

Foreign bodies which, after remaining some time in the tissues, give rise to a superficial abscess, require also that the abscess shall be punctured, and that they shall be extracted.

Animate foreign bodies demand special treatment. The ticks of the dog are removed by the simple touch of a piece of cotton moist with benzine. Linguatulina are made loose by nasal douches of cresyl solutions, ammonia, or benzine; from the connective tissue of cattle and horses hypoderms are extracted by squeezing. The parasites of the digestive canal are expelled by anthelminthics and purgatives; those of the respiratory apparatus by fumigations of tar.

Aseptic liquids gathered in cavities existing inside of tissues may be

absorbed rapidly, or, on the contrary, remain there without sustaining any sensible change. Often, by allowing their escape, the duration of treatment is much shortened. Modified physiological fluids and some pathological collected in the tissues or in natural cavities ought to be evacuated at once. A severe antiseptic treatment should follow.

As to *gases*, they are generally absorbed by degrees or eliminated. According to the case, they are left alone (expecting treatment), or their expulsion is stimulated by massage, or an outlet is opened to them by puncture.

CHAPTER II.

SECTION I.

TRAUMATIC LESIONS.

The old division established for traumatic lesions must be retained when they are considered from the point of view of their mode of repair and of the therapeutical measures they require: thus we recognize *external, open* or *exposed* traumatic lesions, in which the teguments—skin or mucous membranes—are divided; and *internal, subcutaneous*, or *interstitial* lesions, which are without solution of continuity of the skin or internal mucous membranes. Both kinds may open in pre-existing cavities or in natural reservoirs or canals; then they are called *wounds of cavities* (plaies cavitaires), and are divided into *external* and *internal.*

All traumatic lesions offer for consideration in its walls three zones: 1. A *modified* or *gangrenous zone*, whose existence is constant but extent variable. At times, when it is very limited, and represented by little necrobotic parts or reduced to the thin layer of the anatomical elements, which have directly received the action of the disturbing body (cuts, pricks), it does not prevent immediate reunion; at other times, when it is very extensive, is formed of crushed tissues, and infiltrated with blood and serosity, in which the blood-vessels are destroyed, severe complications are to be expected. 2. A zone called *stupefied* (*stupefiée*) or *ischæmic*, which surrounds the preceding, and in which the tissues have lost their vitality, a zone in which the elements can recover their activity quickly, but which, on the contrary, becomes easily a prey to gangrene if severe phlegmasic phenomena occur. 3. A *zone* of *irritation*, peripherical, which is going to be the seat of great hyperæmia, exudation, and leucocytic immigration more or less abundant, where began the changes leading to the separation of the wound, and from which start those which complete it (Verneuil).

These complex phenomena which accompany traumatic lesions show peculiarities which depend upon numerous causes; upon their exposure to the air or the protection of the wound by the tegumentary membrane, upon their extent, their depth, the nature of the involved structures and the seriousness of the hurt they received; upon their aseptic state or the interference of pathogeneous micro-organisms, and also

upon the constitution of the patient, the diathesis or the organic affections he may have.

In veterinary medicine but little is known of the modifications made upon traumatisms by infectious and general morbid states, or of the mutual influence these have upon each other. Numerous facts, however, seem to show that it is the same with animals as with man. Max Schüller, in experimenting with rabbits, has shown the influence of traumatisms upon tuberculous manifestations, thus elucidating the pathogeny of bacillar arthritis. In animals which have had disorders of a rheumatic nature, traumatism may give rise to new localization or to an excitement of the diathesis, especially of articular inflammations, when it exists close to a joint. Reciprocally, in those animals, one may observe after wounds some unusual phenomena. In certain patients, under the influence of a cancerous diathesis, a traumatism may develop a cancer in the injured region. In general, the progress and the cicatrization of wounds do not seem to be influenced much by carcinosis as soon as the organism is not below par; we see quite often, in dogs, wounds after the removal of cancerous growths, healed rapidly without relapse *loco vulnerato;* but when carcinosis is old, on the road to generalization, and has brought on cachexia, traumatic lesions are repaired but slowly, and often accelerate the progress of propathy. It is the same in cases of sarcomatosis. One of us has related the case of a dog having a sarcoma on the head of the femur, in which the generalization of neoplasia took place rapidly, after a needle cauterization upon the primitive growth, the nature of which had remained unrecognized. In diabetic patients the tissues are not only impregnated with sugar, but they are also altered in their nutrition: spontaneous ulcers may develop themselves, as has been seen in dogs. These ulcerations and all accidental traumatisms predispose to gangrenous and septic accidents. On the other hand, it has been known for a long while that certain traumatisms give rise to diabetes: such as wounds of the heart and of the superior part of the neck, which drive back the cephalo-rachidian fluid and secondarily bruise the floor of the fourth ventricle (Cl. Bernard); serious lesions of the vertebral column, or violent contusions of the thorax and of the abdomen, which bring with them functional disturbances in the pancreas or the liver. Albuminuric subjects when wounded are predisposed to œdema, phlegmonous inflammations and to suppurative lymphangitis and adenitis. With them traumatic hemorrhages are ordinarily abundant, and secondary hemorrhages frequent; with these, also, wounds assume frequently an ulcerative character or become complicated with diffuse phlegmons or with gangrene. It is known that large suppurating wounds, and bony lesions in particular, may give rise to renal lesions (infectious nephritis) followed by albuminuria. In subjects affected with hemophilia

or leuchæmia, slight traumatisms are often accompanied by considerable hemorrhages, which are sometimes fatal; in dogs affected with ganglionary leuchæmia (adénie), the extirpation of a single ganglionary mass is followed by abundant hemorrhage, very difficult to stop. Traumatisms of operations, or those that are accidental, may be followed by inflammatory or septic complications.

Among visceral diseases, *affections of the heart* give rise to a circulatory trouble which may produce dyspnœa, œdema, ascites, or hydrothorax. On that account the wounds of patients affected with these bleed profusely; sometimes, besides, there are vascular alterations. Œdema, which occurs in patients affected with heart disease, expose them, as in those affected with albuminuria, to erysipelas and to phlegmons. In patients with heart-affections, traumatisms may bring on phenomena of asistole. Diseases of the liver (cirrhosis, fatty and amyloid degeneration) carry with them numerous disorders—interference with the circulation, digestive troubles, alteration of the blood—which have a great influence on the progress of the traumatisms. These become the seat of a hemorrhage difficult to stop, and of diffuse inflammation; they are often accompanied by erysipelas, lymphangitis, profuse suppuration, and these predispose to pyohæmia and septicæmia. Traumatisms are not without influence upon the evolution of hepatic affections; they may stimulate in them a sudden aggravation.

Finally, all *acute diseases*, accompanied with intense fever, and in particular infections, act on traumatisms and interfere with the repairing process. Let us also mention as such, age, species, breed.

Traumatic lesions of diseased tissues present some peculiarities and expose them to complications which vary according to the alterations of those tissues. In hyperæmic parts or those affected with acute inflammation, hemorrhage is always abundant, and the cicatrization by first intention rare: complications of diffused inflammation, phlebitis, lymphangitis, are frequent. Wounds of suppurating surfaces expose the patients particularly to erysipelas, lymphangitis, pyohæmia and tetanus; therefore, as far as possible, one should avoid injuring those wounds. When traumatisms involve tissues already altered by chronic inflammation, the consecutive phenomena are sometimes nearly like those which take place in sound tissues; at others, one will notice a return of the phlegmasia to an acute stage, the suppuration increasing, after which recovery takes place; then again the wound may assume an ulcerative character.

I.

WOUNDS FROM SHARP OBJECTS (INCISED WOUNDS).

Whether wounds arise from the *operation* or from *accident*, immediate union is possible; and one should try to obtain it. The conditions for cicatrization are known: clean, regular or recent wounds; edges smooth, of good nature, without indication of mortification; perfect hemostasis; exact and entire adaptation of the surfaces; absence ot foreign substances; above all, no infectious elements in the wound; protection of it with a dressing; and, finally, freedom of the wounded from diathesis or any other morbid state likely to influence the wounds unfavorably. The edges of wounds from sharp instruments are, in general, but little altered, easily adapted throughout their whole extent, are not ragged or irregular, and are without loss of tissues endangering vitality.

Loss of substance which is not extensive does not prevent immediate union; but the regular juxtaposition of the edges is more difficult, and their tension by the sutures is an unfavorable condition. Accidental cuts sometimes have borders more or less bruised and ragged; they will be cleansed with the bistoury before being brought together. If a thin clot of blood interpose between the edges of the wound, it will be absorbed after they have been brought together; if, by it, the union of the surfaces is only made slower, and large clots separate these surfaces mechanically, they constitute a favorable soil for the micro-organisms lost in the wound, and, besides, facilitate the purulent destruction.

If the wounds are aseptic, all that is necessary to obtain adhesive union is to avoid all contamination. It is useless to inundate them, as is still done so often, with strong bactericide solutions, which irritate and necrose the anatomical elements of the superficial layer of the edges. Boiled water is sufficient for these. For such as have been soiled with the instrument or the cutting object, with the hairs, dust, straw, manure, or mud, antisepsis is necessary, and strict cleanliness indispensable. The edges of the wound are still well nourished, the anatomical elements have still their activity, the leucocytes come rapidly to strengthen the defence; but these favorable conditions are not sufficient to prevent infection by the staphylococci, streptococci, tetanic or septic spores. After these wounds have been badly dressed, one often sees tetanus or septicæmia make its appearance. In such cases, a simple disinfection with any antiseptic liquid is not sufficient; strong solutions and copious irrigations are necessary.

When the region is not prepared, the skin of the peritraumatic region

should be shaved and disinfected; then the raw surfaces should be purified as indicated.

The condition of the wound justifies the attempt to have immediate union. If the blood flows yet in abundance, and in streams, it can be stopped by affusions of cold boiled water; if it escapes from a large blood vessel, a small vein or artery, hemostasis should be made with one or several catgut ligatures, which will be absorbed. The ends of the catgut should be cut close to the stopper knot; and there the edges of the wound should be brought close together, and held in position by sutures, carefully placing in coaptation the similar portions of the two juxtaposed surfaces. Sutures with close stitches made of silk threads, or silk-worm gut, are preferable to metallic sutures. With deep wounds, the mortified parts should be avoided, by adding deep sutures made with catgut to the superficial. These deep sutures will hold the edges of the wound close together, in their entire thickness, for a length of time sufficient to permit adhesion to take place. We will mention, merely for the sake of calling to memory, the sticking bands and uniting bandages, all of which are inferior to sutures and are therefore left aside. According to the region, the wound should be closed with iodoform collodion or covered with a wadding dressing, after having been powdered with iodoform or with a coat of iodoform vaseline. When once the union is obtained, the sutures not absorbed should be removed.

In wounds with exeresis, interrupted suture has the inconvenience of producing on the edges too severe a tension; and often the tissues are cut by the stitches. Twisted suture holds the borders of the wound close together and is advantageous for solutions of continuity which divide entirely the walls of natural openings or of some delicate structures (lips, nostrils, false-nostrils, eyelids, or sheath). When the dieresis involves deep down an aponeurosis, a tendon or a bone, a tendinous sheath, a synovial membrane, one of the great serous structures, or one of the visceras they contain, in general, immediate treatment does not present other difficulty than a minute antisepsis and occlusion.

If adhesive reunion has failed, and the wound suppurates, it should be disinfected with a strong antiseptic solution (corrosive sublimate 1 in 1000, creolin or carbolic acid 4 or 5 %, chloride of zinc 8 or 10 %) or with atomizing or baths of a less concentrated solution; it should be covered with a dressing, or left exposed. Experience has shown the superiority of these agents over alcohol, camphorated alcohol, or tinctures, even those of arnica or glycerine. To assist the escape of the pus is a principle which is more strictly followed to-day than ever before. At times, it is necessary to drain the part with a fenestrated tube fixed to the borders of the wound by a stitch of suture; when the wound is

partly filled with granulations, the drain is removed. With deep suppurating solutions of continuity of the superior regions of the body, free incisions or counter-openings are often required.

A simpler treatment, used for numerous superficial wounds, consists in washing them several times a day with salt and water and covering them with absorbing or antiseptic powders (those of coal, coal-tar, camphor, tannin, alone or mixed with iodoform). But until these wounds are entirely covered with a coat of granulations, infectious complications are to be feared. The surest way to prevent them is to make a free use of microbicide solutions.

II.

WOUNDS FROM PRICKING OBJECTS. (PUNCTURED WOUNDS).

The gravity of these depends especially upon the tissues or organs that are involved, and upon the size, form, and aseptic or infected state of the injuring object. Pricking bodies with sharp points, fine and smooth edges, penetrate while separating the anatomical elements, which are destroyed in small number only, and the phenomena following are simple. The innocuity of exploring punctures made with trocars or needles of small dimension is well known, there is a like simplicity of phenomena following subcutaneous operation, wounds which have decided analogies with pricks from two points of view—the way they occur, and their character and mode of repair. Let us recall again to memory the cases where people have implanted a number of needles deeply in certain regions, without any accident following. It is also known that needles, *unthreaded*, which are swallowed, can pass through the walls of the digestive tube and travel through viscera without doing any serious mischief; in dogs and cats, it is not rare to find encysted in viscera or in the tissues, needles whose presence was never suspected on account of the absence of all pathological manifestations. It is very different when the needle carries a thread, since it bears with it infectious elements which give rise to septic complications.

If larger points, conical or prismatic, enter also the tissues and separate their elements, they compress them more, and easily lacerate them. Bodies with blunt or ragged points, those whose edges are rough, bruise and lacerate the organs, and make a lesion with contused walls and an irritated zone which may afterwards mortify. The wounding agent may open a vein, an artery, a synovial sac, or one of the great serous membranes, and may break into the tissues. Often it is soiled and loaded with phlogogenous or septic germs, so much the more serious as the tissues are more delicate. Infected pricks of aponeuroses, ligaments, tendons or bones, ordinarily, are followed by limited necrosis

of those organs. Penetrating wounds of tendinous sheaths, of articular synovial sacs, or of splanchnic cavities, are, ordinarily, accompanied with diffused inflammation of those membranes. Complications of tetanus and of septicæmia are likely to be fatal where the agents of these serious infections are deposited in the punctures (wounds with stable forks, with the tooth of a harrow, or with a nail).

Wounds from prickings when free from infection heal rapidly. Immediately after the extraction of the wounding object, the separated tissues return close to each other. The narrow solution of continuity is soon filled with plastic lymph, with leucocytes, and with proliferating elements, and cicatrization is a matter of a few days. All that is required is to assist the repairing process. Clip the hairs all round the prick, disinfect the tegument and the edges of the wound, close it with iodoform collodion ; such are the rules to be observed. The same treatment should be used for pricks made with points of larger dimensions, which contuse and bruise a thin layer of the tissues pierced, but do not carry with them infectious elements. Rapid occlusion is especially important with penetrating wounds which open an articular serous membrane, the pleura, or the peritoneum. The old treatment, which consisted in finding out, by probing, the depth and direction of those wounds, to enlarge them or enlarge their sides, is now condemned. To wait for developments is the rule, even when the wounding object has been broken and has left its point in the tissues: if it is aseptic, only a light reaction will follow, and it will become encysted. Examples are common of pricks, which look serious at first, but heal without complications. The same is true of the numerous penetrating wounds of a horse's foot, although made by soiled substances, which, however, in piercing the hoof, have been relieved of the impurities deposited on their surface.

Infected punctures are not slow to give rise to acute pains accompanied with great tumefaction of the wounded region. These manifestations are treated with antiphlogistics, continued irrigations, especially with antiseptic baths or nebulizations. If the lesion is on the extremity of a leg, one will have recourse to repeated immersions in a carbolic acid, a cresyl or a luke-warm corrosive sublimate solution. Sometimes the inflammatory manifestations subside, at others they remain or increase, pain becomes excessive, and tumefaction diffuse; then, most commonly, either pus collects at the bottom of the wound, or the inflamed tissues are compressed by an aponeurosis, or an irritating foreign body remains there implanted. At this point one should interfere at once. Without loss of time the first puncture should be freely enlarged, in order to allow the pus to escape, if there is any, the phlogosed tissues should be relieved, and the irrigations or the antiseptic baths should be continued. The enlarging of the wound assists the

resolution of the inflammatory process, and allows the elimination of the foreign body which may have been retained. Even when the phlegmatic phenomena are intense, it is better to wait for this spontaneous elimination than to make with probes and forceps attempts and explorations which are always very painful and without real usefulness.

In small animals, wounds are often observed which were made by curved pricking objects (hooks of any kind) still implanted in the tissues. These objects must be removed by enlarging the opening of their entrance, or by pushing them through the tissues and extracting them by their points.

Some voluminous pricking bodies produce deep wounds, with bruised borders, which suppurate abundantly after a few days. These lesions must be treated like contused wounds.

In exceptional cases, punctures may injure an artery and give rise to abundant hemorrhage. This requires plugging and sometimes the enlarging of the wound for the application of a ligature on the blood-vessel.

III.

CONTUSED WOUNDS.

These, very unlike in their external aspect, extent, and depth, include numerous varieties, representing all the possible intermediate stages between simple excoriation and the most serious traumatisms with attrition of the different tissues of a region and the bone which forms its base. Most of them are extensive, badly defined, with thick ischæmic surrounding, infiltrated with blood and threatened with slough.

From the therapeutic point of view, we will arrange them in three classes: 1. *Superficial*, having excoriation for type; 2. *Deep*, with ischæmiated zone of slight thickness; 3. *Deep*, with wide contused zone, bruised and doomed to have gangrene.

Superficial contused wounds heal quickly, almost always without accidents of any kind. It is sufficient to cut the hair surrounding them, disinfect them, and cover them with a coat of collodion or of powder of pulverized coal, or tannin alone or mixed with iodoform (3 to 5 parts to 1.) Sometimes, though superficial, they are painful; the animals try all the time to rub it or bite it; opiated ointment or cocaine vaseline may be of advantage in such cases. In some regions, especially the legs, a strict disinfection and an antiseptic dressing will, very often, bring on recovery without noticeable suppuration.

In deep contused wounds, whose inflamed zone is comparatively limited, quick cicatrization, without slough, is possible. They must be carefully washed, cleaned of all foreign bodies which may be deposited upon them, and purified with a disinfecting solution (corrosive subli-

mate, carbolic acid, creolin, chloride of zinc, or permanganate of potassium; their edges must be trimmed smooth, by cutting off all parts too much bruised and even a little more, and they must be joined in places by sutures closed or far apart, with or without drainage, as the case may be. Little attention needs to be paid to the hemorrhage, even when arterioles or veinlets are lacerated; the crushing of the external coat and the retraction of the two others insure hemostasis. When vessels of larger caliber are opened or divided, one must guard against the possibility of a secondary hemorrhage and apply to them catgut ligatures. According to the region where the wound exists, this must afterwards be covered with an antiseptic dressing or with a coat of vaseline, also antiseptic. If the wound gapes widely on account of the retraction of the tissues on the border, is without great loss of substance and does not threaten gangrene, sutures may also be useful; they bring the edges together, maintain them in proper position, make the space to be filled smaller, and cicatrix is limited, so that recovery is more rapid. But when the loss of substance is considerable, none of the previous means is to be applied—no sutures, no drainage; other methods must be used. Wounds with gangrenous strips require washings, baths, powders,—all of an antiseptic nature,—or continued irrigation.

Very severe contused wounds, whose edges are bruised, crushed, loose, or hollowed by anfractuosities, must be treated open, with or without dressing, according to the region where they exist. After proper cleaning by cutting, with bistoury or scissors, the disorganized tissues, which are doomed to gangrene, should be disinfected with antiseptic washings; in some cases, free incisions and counter-openings should be made, to prevent the stagnation of the pus in the irregular and undermined structures. In some regions where the involved muscles are covered with an aponeurosis, the tumefied muscular tissue may protrude through the solution of continuity of the aponeurosis; it is then advantageous to incise the latter. Sub-aponeurosis phlegmons should be punctured at once, drained and irrigated with antiseptic liquids. Contused wounds with bony lesions (face, withers, hip) require, ordinarily, a long time to cicatrize, and are often accompanied with necrosis or other secondary affections. (See *Necrosis*.)

Of all traumatic lesions, these are the most dangerous, as regards infectious complications. Therefore, it is emphatically commanded to relieve them of whatever foreign substances they may contain, and to purify them of all contamination they may have received. Irrigation can never be too abundant, if the wound is irregular, anfractuous, undermined, or if the tissues have been soiled with hairs, manure, gravel, earth or dust. When the wounded part allows it, when, for instance, the injury is below the knee or the hock, it should be soaked for twenty

minutes or half an hour in a warm antiseptic solution. For serious traumatisms of the trunk and of the superior parts of the extremities, we have sometimes resorted during the first few days to nebulizations (atomizing) of corrosive sublimate or carbolic acid, made with the atomizer of Lucas-Championnière. Balneation or nebulizations are continued until the elimination of the sloughing tissues. In other cases, after the wound has been well disinfected, it is sufficient to irrigate several times a day with a solution of cresyl or common salt, and to cover it, after each washing, with iodoformed vaseline or to dust it with an antiseptic powder (iodoform, naphtaline, tannin, coaltar) in sufficient quantity to cover it entirely. Continued irrigation is also used with much success : it is generally employed for contused wounds of the extremities on horses. It removes the secretions, diminishes the sensibility and the pain, and attenuates the intensity of inflammatory accidents. It is stopped when the wound is cleaned and free from all shreds of mortified tissues ; it has the inconvenience of retarding the cicatrization by rendering the granulations soft or fungous. The facts recorded by Trasbot have confirmed the remarkable efficacy of cold irrigations in the treatment of traumatisms of horses ; it is important that the water should not be too cold, since the continued action of cold would be injurious, especially if parts of some dimension were already under the influence of ischæmia.

Warm antiseptic baths, given twice or only once a day, with iodoform dressings, constitute a treatment a little more complicated than cool irrigations, but also more certain and more rapid. We obtain good results with it. Recently, we have employed it with great success, for a saddle horse severely injured by a tramway : the canon, fetlock coronet and head on their anterior faces had a long contused wound, with ragged edges ; the tendon of the anterior extensor of the phalanges and the periosteum were bruised in several places ; the synovial bursa of the fetlock was open. No complication took place ; after a month the wound was entirely healed.

It is the exception that treatment of wounds, accompanied with fracture of a bone of the extremities, or with articular lesions, is undertaken. For them the treatment of compound fractures or of open joints is necessary.

To contused wounds of the lower regions of the extremities, produced by the shoe, is often added a local, active, and diffused phlegmasia, lymphangitis, and sometimes inflammation of the tendinous or articular synovial sacs of the fetlock. For them especially, antiseptic baths and wadded dressings must be used. In some cases (horses that interfere) repetitions of the trouble must be prevented by proper shoeing or protective apparatus.

IV.

WOUNDS FROM FIRE-ARMS. (GUN-SHOT WOUNDS).

Particularly frequent among army horses and hunting dogs, these wounds vary indefinitely with the size and the penetrating force of the agents which produce them. How different, as far as lesions and severity, the contusion produced by a dead ball, the burn resulting from the deflagration of the powder, the narrow perforations of small shot, from the enormous mutilations made by big projectiles! And how numerous are the intermediate degrees between those extremes. The wounding agent may be a regular projectile or a fragment of a small bomb, a metallic substance with a sharp edge or a splinter of wood torn by the projectile. If the latter penetrates the tissues, it may introduce into them a foreign body—a fragment of metal, a piece of leather or of cloth.

Penetrating wounds involve injured bones in about a fifth of the cases. Out of 211 wounds by fire-arms observed by Jewsejenko during the Russo-Turkish war, 41 (19%) were complicated with bony lesions (bones of the head, 12 cases; vertebræ, ribs, pelvis, 14; anterior legs, 7; hind legs, 5; foot, 3). The most serious lesions were those made by lead projectiles.

Wounds by fire-arms are generally characterized by their peculiar aspect; their borders, of leaden tint, brown, purple, or blackish, are contused and ragged. Wounds made with modern arms differ much from those made with ancient projectiles. The Lebel ball, conical, with a very hard metallic envelope, has a considerable penetrating force; it runs through the tissues in a straight line and perforates and crushes bones into splinters. The curious deviations observed from the spherical balls of old guns, the "turning" shots, are exceptional with the projectiles of modern warfare.

The therapeutics of these wounds has varied with the times. Old surgery believed them "poisoned" and recommended cauterization with the red iron or boiling oil. Later, free incisions and immediate extraction of the projectiles was the rule. To-day, they are treated as contused wounds are treated, and when the wounding agent has remained in the tissues, most commonly it is left there.

In animals, since the skin is protected by an abundant coat of hair, it is rarely affected by burns from gunpowder; and the incrustation in the skin of some of it which had not burnt is without importance. The eye may, however, be severely affected (Rey, Kopp). Upon a horse which, at Montebello, had remained some time near the mouth of a piece of artillery which was firing, Kopp observed, the next day,

a severe inflammation of the eye; the entire exposed surface of the ocular globe was filled with little wounds looking as if they had been made with a punch. Subcutaneous lesions produced by dead projectiles, which push into the skin without running through—lesions attributed in days gone to the "wind of the ball or the bullet,"—must be treated as contusions. If the skin and the superficial subcutaneous layers become necrosed, the sloughing of the mortified tissues should be attended to. (See Gangrene.) The examination of a contused wound of the hoof by a ball (Kopp) disclosed the fact that the deep layers of the hoof were infiltrated with blood, as in a corn, and that under the wall there was a small hemorrhagic center.

A load of shot, if fired at short range, has the effect of a bullet, and gives rise to all the disorders of the most contused wounds; if the shooting is made at long range, the shot penetrates the tissues separately, and makes in them narrow and more or less deep tracts, at the bottom of which it is enclosed in a cyst. Only the shot that is superficially situated, which is troublesome, or is arrested in delicate tissues, such as the eyelids or the cornea, is removed at once (Peuch).

Wounds in the shape of gutters, hollowed in the skin and superficial subcutaneous layers by a ball which has reached them at right angles, cicatrize by granulations and without severe inflammatory reaction. It is sufficient to make simple washings and to cover them with an antiseptic preparation. Immediate reunion might be obtained in some cases if the contused condition of the borders did not prohibit.

Tubular subcutaneous wounds, like a seton tract, produced by balls of all sizes, which pass through and through a region, generally close quite rapidly and without suppuration, except at their openings. They must not be probed or enlarged unless they conceal some foreign body; in other cases, they are aseptic, just as the tract of a trocar heated to white heat, and the probing exposes them to infection or destroys adhesions already made and interferes with cicatrization. Clip the hair around the openings, wash these with a strong solution of carbolic acid or corrosive sublimate mixtures, cover them with iodoform or iodoformed vaseline, and immobilize the region. These are the only truly useful measures to take. If a fluctuating center appears in the subcutaneous tract, it should be punctured, the cavity washed, all foreign bodies that it may contain removed, and then it should be dressed as the openings were. When the tracts of the wounds running in the depth of a region pass through an aponeurosis, if the tissues underneath become highly inflamed and suppurate, it is necessary to enlarge the tract and drain it. The hemorrhage which takes place in some cases is also a condition which demands free incisions, but the march and the gravity of the trouble depend, after all, upon the importance of the injured organs. It is evident that balls, which thus

run through some regions, may produce mortal accidents (perforation of the intestines, of the lung, of the heart, or of the brain.) Let us again say that a projectile that breaks up upon a bone may make three openings on the skin; and that the existence of two openings is no proof that the region has been run through, as the two openings may be those of entrance of two balls which have not made their exit.

The projectile has penetrated the tissues in making a blind tract with one opening only: it remains in the region: what is the treatment? Of yore, extraction, whenever possible, was recommended; but numerous facts have shown that the balls, which are almost always aseptic, are tolerated in the great majority of cases. Then systematic abstention is the rule of conduct adopted now by most surgeons. The wound and its surroundings is carefully examined: sometimes palpation reveals a hard spot, a slight projection formed by the ball; with a stroke of the bistoury those are brought out that are arrested just under the skin; those that are lost in the depth of the tissues or have penetrated the viscera are left alone. Wounds of the lung are relatively harmless compared with those of the encephalon, spinal cord, or heart, which are nearly always fatal. The penetration of a ball into abdominal or thoracic cavities is not necessarily followed by complications; and the rule is, not to attempt the extraction. The question in human surgery as to the course to take with abdominal wounds is yet undecided.

Reclus, who is a great admirer of abstention, admits interference "not for the extraction of the projectile, but to repair the mischief it has done by its passage: such as, the opening of an artery or a large vein; the section of a nerve or of a tendon; laceration of a viscus, the stomach, an intestine, or the bladder." We do not interfere for like occurrences among our large domestic animals. For the others, one must be guided by rules laid down in human surgery. We will return to this subject in the chapter on Traumatic Lesions of the Intestines.

When the projectile is arrested in a musculo-aponeurotic region and produces in it violent inflammatory phenomena, it must be looked for by exploration of the tract of the wound. Sometimes the size of the canal permits the introduction of the index finger, but ordinarily it has to be enlarged by incision: an aseptic grooved director is introduced into the tract, and a straight bistoury passed along the groove carries the incision on to the necessary extent. When the projectile is exposed, it is made loose with the extremity of the probe and extracted with the denticulated jaws of long forceps. One should avoid violent manipulations, which might result in injuring the tissues more or in pushing the ball farther inwards: this recommendation is specially important for projectiles arrested in the neighborhood of serous membranes. Bony lesions are always serious complications, with, however,

many variations in their gravity. Ordinarily, balls which are incrusted in bones are left in; if they are extracted, they must be made loose by careful manipulations with the probe or a strong metallic rod; sometimes the operation is quite difficult, and may demand the use of the trephine, the gauge, and the mallet. The special instruments invented in former times to extract projectiles are not employed now.

Fractures of the bones of the face, which are not extensive, also those of the spinous processes of the withers, of the point of the hip, and of the ischial region are the least dangerous. On the contrary, those of the bones of the extremities, which are often comminuted, as well as the articular lesions, are cases of extreme gravity, and are, economically, incurable. Wounds of arteries and large veins—cases which are rather rare—give rise to an immediate and abundant hemorrhage, and ordinarily require the ligature of the injured blood-vessel.

If, in general, the tissues are tolerant of balls, they are not so of the foreign bodies which the balls have carried with them. For those, extraction is almost always necessary; and this should be done with long forceps.

Projectiles of *large caliber* (boulet, obus), almost always produce enormous lesions. At times, they take off a leg or a part of the head; at others, they reach the neck or the trunk, thus causing, in nearly every instance, irreparable disorders, if not death in a few minutes. Even when the thoracic and abdominal walls appeared but little injured, the viscera—lungs, heart, liver, and intestines—are contused, bruised or torn. Some regions, however, may be touched side-wise and injured quite deeply, without complications of fracture, injury of large vessels or important nerves, or opening of a natural cavity. These traumatisms present all the characteristics of serious contused wounds, and must be treated as such.

Though wounds by fire-arms are ordinarily free from infection, they may be complicated with diffused phlegmons, gangrene, pyohæmia, septicæmia or tetanus. The last two infections are generally the result of an inoculation of the wound, after the injury by the earth, the dust, or other matters containing the septic or tetanic germs.

In cases where treatment is undertaken hygienic measures should not be neglected. If the wounded is suffering from the shock, and is weak or depressed, stimulants and tonics should be administered.

Projectiles, left in the tissues, behave in different ways. There are some which, having reached certain organic cavities (nasal, buccal pharyngeal, stomachal or intestinal) or having been arrested in these are eliminated through the natural passages. It is thus that balls which have entered the intestines are rejected through the anus. Quénu has related to the Society of Surgery, a case particularly curious: a man who had received a ball from a revolver threw it out three weeks later

by the pharynx (1). In other cavities, if they remain, they may produce suppurative inflammation. The biscaien that Rigot found in the guttural pouch of a horse, which he dissected, had given rise to a suppurative collection in that sac. Many become fixed, or encysted, and after the wound which they have made has cicatrized, nothing remains to indicate their presence. The observation of Trasbot is an example of it. At the autopsy of war-horses, balls were found enveloped in a cellulo-fibrous case in various regions, even in the viscera. In man, they have been found in the brain. But there are projectiles, which, while remaining innocuous for years, travel along conjunctive layers, moving by the laws of gravity or through the effects of muscular contractions. In general, they move slowly, giving time for encysting to take place; then, under the influence of the continued pressure that they make upon the dependent portion of their cystic envelope, the latter gives way, and the body thus progresses slowly through the tissues; the walls of the cyst close, unite, and form a fibrous tract, which may be found afterwards (Ferrier). In a horse, which was wounded, in 1866, with a ball that had entered the lumbar region and could not be extracted, Möller found, ten years afterwards, the projectile near the umbilicus; it had produced no trouble during all that time. Sometimes, in thus displacing themselves, or even in remaining in one place, projectiles give rise, on occasions, to various accidents—abscesses, neuritis, arthritis, or inflammation of the large serous membranes. The horse spoken of by Carnet, kept for four months, in the lumbar region, a ball which, one day, after a long journey, gave rise to an acute diffuse phlegmasia, and an abundant suppuration, followed by death in a week. (See *Foreign Bodies.*

V.

WOUNDS BY TEARING. (TORN WOUNDS.)

This kind of wound is observed in all animals; but with the exception of the *wrenching of the hoof*, most of them, generally of little gravity, have nothing compared with the great traumatisms, now so frequent among men, because of the extensive part machinery takes in modern industry.

Ordinarily the torn wounds that we have to treat in animals are made by nails or hooks, and are very much like contused wounds with a thin ischæmic zone. Very often their edges are as nearly regular as those of incised wounds; and when they are recent, if their borders are brought together after having been minutely cleaned of all soiling on their sutures, they may unite by first intention. This

(1) Quénu, Semaine Médicale, 1894, p. 328.

result is often obtained for wounds of the lips, of the nostrils, eyelids, and for those which, in all regions, involve only the skin and the superficial subcutaneous layers.

Upon animals that work in railroad stations, mines, and iron foundries, more extensive and deeper lesions can be seen,—wounds with tearing of the muscles, and the tendons, and with fractures. Rey has related the case of a horse, which was thrown on the rails while drawing cars, and was dragged thirty meters and found covered with wounds, the lower jaw having been fractured as far as the neck, hooked to a switch, the bone had been fractured and its lower part was held only by a thin band of tissue. Violent contusions applied obliquely, and bites also, give rise sometimes to lesions resembling torn wounds. There are several cases of horses, an ear of which has been taken off by a bite or by a kick.

Large tearings, when curable, must be treated as contused wounds. They must be carefully disinfected with washes or warm antiseptic baths, and their edges brought close together with sutures and covered with an iodoform dressing. A simpler and more economical treatment consists in washing them frequently and covering them with absorbent or antiseptic powders.

When these injuries are situated on the legs, continued irrigation is ordinarily employed. (See Wrenching of the Hoof.)

VI.

WOUNDS FROM BITES.

These wounds have various characters, according to the animal that has made them. They may have the aspect of cuts, punctures, bruised, contused or torn wounds. Those made by horses are principally contusions or contused wounds; the tissues are bruised and crushed; two curved marks separated by an oval tumefied zone are sometimes made on the skin by the incisives; when the skin is torn, the wound is, ordinarily, irregular and ragged, even sometimes when the edges are clean. Wounds made by large ruminants, rare and not serious, look, also, like contusions and contused wounds. In the bites of dogs, the wounding dental arches make several punctures, with crushing, cuts, and tearings of the tissues. With those of cats, one or several punctures, generally somewhat deep, are found made by the canines. Bites of large carnivorous animals are terrible; often there are laceration of tissues and disorders rapidly fatal. Some birds with their straight or crooked beaks may make bites by punctures or by tearing. Large bites made by horses are rather often complicated with crushing of bones; the muscular force that closes the jaws is considerable;

sometimes the lower jaw breaks under the effort (See Fractures). Also there are found the bites that dogs inflict upon each other during fighting, fractures of the bones which form the basis of the wounded region (face, extremities). We have just treated a hunting dog bitten deeply on the shoulder by a bull-dog, in a short struggle, and in which the neck of the scapula had been fractured by a bite of the teeth.

The therapeutical treatment that all these lesions require, allow them to be arranged in two groups: 1. Those where the contusion is more or less severe; 2. Those where the skin is perforated or torn.

Bites of the first variety heal, ordinarily, without complications. To allay the pain, often great, tepid affusions or baths are used; sometimes emollients and narcotics. If the bruised structures undergo mortification, their sloughing can be stimulated and the wound treated as ordinary contused wounds are.

Bites of the second variety—bites open or with wounds—must be carefully disinfected with free antiseptic irrigation or immersion in a tepid bath. The lesions, sometimes deep, that are inflicted with the teeth do not exhibit all the gravity of the injury; there is also the possible infection with the saliva or other noxious substances which the teeth may have carried into the wound. Not only does saliva contain toxic leucomaines, but also numerous microbian species which can bring on an intense local phlegmasia, suppuration, and phlegmons of the wounded region. Tetanus, erysipelas, pyohæmia, are complications to be feared with serious bites. Minute disinfection of the wound and antiseptic dressings are the best preventive treatment of all such accidents. In some cases continued irrigation will be preferred. As in contused wounds, it may be necessary to make some excisions or to enlarge wounds with incisions or counter-openings.

Generally wounds from bites bleed little. They may, however, be accompanied with abundant venous or arterial hemorrhage, which then necessitates the enlarging of the wound and the application of ligatures. Latulle treated a horse which, having been bitten (probably by his mate) on the right side of the neck, near the jugular, had on that point a ragged wound from which red blood escaped. The jugular and the carotid had been opened so that ligature was required. (1)

VII.

POISONED WOUNDS—VIRULENT WOUNDS.

Whatever may be the causes and the mode of their production, whether due to the action of a wounding body or a bite, these wounds are essentially characterized by the deposit, in the injured tissues, of a deleterious substance—poison, venom or virus. What makes them

(1) Latulle, Journ. of Milit. Vet. Med. 1867-68, p. 413.

serious, is the introduction of this injurious substance into the traumatic center; if, however, the extent and the depth of the lesions are sufficient to influence the accidents that may follow, by opening a more or less wide entrance to absorption, they have only a secondary importance.

For a long time it was believed that there was a rapid and complete absorption of the soluble poisons, venoms and virus; but experiments have shown that if most of these agents diffuse easily, the absorption of them is influenced by numerous circumstances, and, during a certain time, a part remains on the wound, as well as in the superficial layers of the wounded tissues. Among these agents, there are those which spread quietly in the tissues, and are absorbed without producing any local reaction; others, possessed of very active phlogogenous properties, which gave rise all round the traumas to intense inflammatory manifestations; and also others, caustic in character, which produce the scarification of a peritraumatic zone more or less extensive.

Poisoned Wounds Proper—and under this name we include those in which are deposited vegetable poisons (alkaloids), mineral (mercurial, arsenical, carbolic acid, iodoform) or putrid poisons (ptomaines)—carry with them a requirement of the first importance: immediately and profusely irrigate the wound with water or an antiseptic solution, thus freeing it from the toxic matter which has not yet penetrated the surrounding structures; remove either by ablation or cauterization (according to the nature of the case and the toxicity of the substance), the superficial layer of the trauma or keep soaking the affected part in a tepid antiseptic bath; and administer internally an emetic, stimulants or tonics, or agents with special therapeutic properties (antidotes).

The venomous wounds that we have to treat in France are made by adders, the *vipere aspic* and the *vipere peliade* (Kauffmann). The former is the more dangerous; its venom often proves fatal to small animals (dogs, sheep, goats); it may kill large animals also, as is recorded in many instances. The second makes wounds more superficial and less dangerous: it frequently, however, causes the death of small animals when they have not been properly treated. Out of sixty ewes of a flock, bitten by adders, fourteen died (Roche). Channel (from Bourg) has recorded that a brood mare which was bitten on the udder, died five days afterwards. Krebschmar also treated, without success, a dog bitten on the lip. Cases of this kind are not rare.

The therapeutics consists: 1. In arresting the circulation in the wounded region, to prevent or to stop the penetration of the venom into the system. 2. In removing that which may remain in the wound. 3. In contending against local and general accidents.

First, if the region permit it, a ligature should be applied, and tied somewhat strongly above the wound, to arrest the circulation. An

elastic cord is preferable to all others; if one is not at hand, a tourniquet may be improvised with a piece of cord or a twisted handkerchief which is tied and twisted with a piece of stick, a key or the handle of a pocket knife.. This ligature in place, attention should be directed towards the wound. It should be carefully washed with cold water; often it may be enlarged advantageously; its edges should be compressed to expel the venom which may be infiltrated in the tissues and which may be removed with another washing; if the fang of the adder has remained in the wound, it must be extracted. Hemorrhage is beneficial; the blood washes the wound and removes a certain quantity of the venom. Suction of the wound might be made without bad results; the venom has no toxic action on mucous membranes. This, however, is seldom used for animals. The local treatment is completed by cauterization with a strong caustic (chromic, sulphuric, or nitric acid, chloride of zinc) or with the red hot iron. Light caustics (ammonia, nitrate of silver) are useless.

If the borders of the wound are already inflamed, the same method should be pursued; but it is good, besides, to make scarifications on the tumefied zone and to introduce into them antiseptic mixtures. The injections of carbolic acid, 3 p. c. (Waadt), 5 p. c. (Billroth), of solutions of permanganate of potassium 1 p. c., or of chromic acid (Kaufmann) may prevent local troubles or diminish them should they already exist. The numerous specifics recommended here and in foreign countries have not given what they promised; it is better to hold on to those which possess known properties. For general treatment, one should have recourse to diffuse stimulants (wine, alcohol, ether, acetate of ammonia). In South America, drinking of alcohol to drunkenness is considered, for men, an excellent means to prevent death. Hypodermic injections of strychnine (Muller) have also given satisfactory results; the ligature or tourniquet should not remain more than six or eight hours, if one would avoid gangrenous complications.

Venomous wounds of some arachnida (scorpions, tarantula) are treated in the same way.

For bites of adders or snakes, as for injections, prophylaxis has been studied. At first it was observed that the organism seems to accustom itself to the action of the toxic: repeated injections of small doses seemed to allow it to resist better large doses; nevertheless, these still had sufficient power to kill. (Kaufmann, Calmette, Phisalix and Bertrand); later, from this it was found possible to confer on animals immunity from the venom of snakes. The serum of animals thus rendered proof against poison is antitoxic.

Stings made by *bees*, *wasps*, or *hornets* are accompanied with great pains and a large diffuse swelling, at times quite extensive; but in

general these phenomena do not last long, and are not complicated with serious accidents, except among small animals, where cases of death are frequent. Lange tells us that out of seven geese attacked by a swarm, six died within from seven to ten minutes; the seventh remained blind. H. D'Arboval has seen two dogs die from the stings of bees. Other cases are recorded by Crepin and others. Sanitas treated a horse, which after being stung by hornets, was taken with severe abdominal pains and with epistaxis. The horse whose case is published by Saint-Cyr had been stung by bees on the head; the entire lower part of the face became the seat of a large tumefaction, warm, painful, especially well marked on the lips, the nostrils, and the eyelids. The difficulty of respiration due to the swelling of the nose had to be relieved by tracheotomy.

When the stings are numerous, even large animals may succumb rapidly. Guerin de Champneuf reports that a mare and her foal, attacked by a swarm of bees, died after great sufferings. Herron has treated a donkey which died under similar circumstances. Horses have died in ten hours (Albrecht, Funfstück), in six (Funsftück), in five (Clichy, Albrecht), in two (Clichy), in one (Guilleville.)* In the *Recueil* of 1853, Clichy reported the case of five horses, which, having been attached to a wall, were attacked by an immense number of bees and died,—two in two hours, the other three within from four to five hours,—after having, every one, presented symptoms indicating violent pains and a super excitation. Guilleville reports that five horses, closed in a wagon, were killed in one hour by bees. In grave cases, the venomous substance produces a severe inflammation of the skin and of most of the mucous membranes, or patches of cutaneous gangrene, hyperæmia, hemorrhages, œdema of the viscera, especially of the lungs, of the brain, or of the meninges.

If one were called to help in a case where bees or hornets had attacked animals and were still attached in large numbers, he must at first attend to removing the bees, carefully protecting himself, of course, with gloves, cap, mask, etc. Since these insects "fear water," the best way to make them go, is to throw some on their victims. Afterwards, the treatment calls for simple cold water affusions, or lotions with alkaline, ammoniacal, narcotic solutions or petroleum. Lang recommends the following mixture: liq. ammoniæ 15 parts; collodion, 5; salicylic acid one.

We shall not advise friction for the purpose of tearing out the stings

*C. *Peabody* relates the case of a horse, 12 years ago, which died in a little over six hours. He records also an experiment made with an animal which he had stung with a swarm of bees and which he treated successfully by officinal solutions of potassæ internally and hypodermic injections of morphia. (Amer. Vet. Rev. vol. 22, p. 613). (T).

fixed in the skin (Clichy); such friction is painful, and does not loosen these stings, since they are protected by the hair; they can be pulled away with nippers from the surface where they may be seen. Often small abscesses form in the places where these were. Where the stings are numerous the inflammation extensive and manifestations general, stimulants (alcohol, ether, camphor, coffee) are the most efficacious agents. If the swelling of the nose, pituitary or laryngeal mucous membrane renders the respiration difficult and loud, and asphyxia is threatened, tracheotomy should be performed.

To protect animals against certain winged insects (breeze fly, horse-fly), which are very troublesome during warm weather, giving pain and producing swellings on the skin, blankets, or nets, may be used. Ordinarily, the skin is simply washed with solutions of strong odor (tobacco, decoctions of walnut leaves, vinegar, cresyl, carbolic acid and 2–3 % tar, asafœtida). Inflammatory symptoms are treated by showering with water or washing with alkaline solutions.

Virulent wounds, due to the introduction into injured tissues of a ferment that grows and multiplies indefinitely, present a gravity which varies with the malignity of the ferment. Local phenomena and general accidents depend exclusively on its properties: quantity is of little importance, since on account of the faculty of the virus for pullulation, the weakest doses are ordinarily sufficient to bring about infection. Bacteriological researches of the last fifteen years have extended the domain of virulent wounds: to glanders, rabies and anthrax, they have added tuberculosis, tetanus and septicæmia, not to mention others of less importance. All these infections have a period of incubation, which is of variable duration. Sometimes the lips of the wounds are rapidly overrun by an intense phlegmasia produced by the local action of the virus (anthrax, septicæmia); sometimes this phlegmasia appears only after a few days (glanders), in other cases the wound acts as an ordinary simple one, granulates and cicatrizes, and weeks or months may pass before the first troubles, due to the infection, are manifested (rabies).

Experimentation has proved that most virus is rapidly absorbed. Some local conditions may retard the absorption, but generally the blood that circulates through the wounded region has in a few minutes retained and carried in its course a sufficient quantity of specific elements to produce infection. (Renault, Davanie, Rodet). Therefore, a quick and rapid interference is imperative, if one wishes to prevent surely the dreadful consequences of virulent inoculations.

As for venomous wounds, one must, when possible, arrest the circulation with a ligature placed above the wound. This should be washed freely with water, its borders squeezed, the extravasated blood and the virulent matter which may have penetrated the tissues expelled.

Hemorrhage thus stimulated by the water flow is advantageous; the blood oozing out cleans the wound and carries with it the noxious elements. It is evident that the chances of success depend very much upon the length of time that has elapsed since the insertion of the virus. When this has had time to spread in the tissues, washing, squeezing and hemorrhage are no longer to be trusted. The only safe way—and it is sufficient, if the infectious elements are still in the parts surrounding the wound, if the circulating blood has not already scattered them in the organism, or if the lymphatic circulation has not carried them further—is the free destruction of the peritraumatic zone by caustics and the red-hot iron. It makes no difference what agent is used, providing it be powerful and applied immediately. Heated to a white heat, the cautery " roasts " the wound, penetrates its borders, reaches the anfructuosities, and goes on even to the healthy structures. Liquid caustics—nitric, muriatic and sulphuric acid, chloride of zinc and chloride of antimony—destroy also the entire infected layer and the suspected zone. It is sometimes necessary to make several deep eschars, and one should not hesitate, since success depends upon it. Let us add that a late energetic interference is not always barren of results. Many times the red-hot iron, applied several hours after the deposit of the virus, has prevented anthrax infection (Davanie, Rodet). In the same way cauterization of a rabid wound, one hour after the bite, has been beneficial. Ammonia, nitrate of silver and several other light caustics, recommended in olden times, are absolutely useless. As for the so-called specific antidotes, secret remedies and mystic practices, only ignoramuses have faith in them.

VIII.

GRANULAR WOUNDS.

Granular wounds, also known as *granular dermitis*, *summer wounds*, are frequent in warm climates, quite common in the meridional countries of Europe and the south of France, but rare in our latitude and altogether exceptional in Northern regions. Sometimes they appear suddenly and seem to be the result of the action of *nematodes* (Rivolta) which reach the dermis, by ways still unknown, and, settling there, produce a vegetating dermatitis with peculiar characteristics; at others they constitute a secondary affection, complicating exposed traumatic lesions (wounds, sero-sanguineous collections, cysts, open abscesses). Their principal attributes are, a protruding granulation, which covers the entire diseased surface; also caseous or cretaceous *granulations*, round, angular or irregular and of a yellowish-gray color; and a great itching, which induces constant rubbing.

They are *very* obstinate wounds to cure, generally resist all the numerous remedies recommended: emollients, narcotics, astringents, vesications, light caustics, cold affusions or continued irrigation. They can only be healed by excision of the granulations and fungosities with the bistoury, or by destroying them with energetic caustics, such as the red-hot iron.

If the wound is superficial and spreading, the granulating surface should be excised. Often, however, they are implanted so deeply that the curette must be used in addition to the bistoury to remove them completely. With the curette it is easy to clean the walls of the cavities where the layer of morbid tissue presents sometimes considerable thickness. When the wound is once cleaned, it is covered with a dressing, or treated with frequent applications of antiseptic vaseline.

When actual cauterization is used, all the morbid tissue must be destroyed with cauteries in point, heated to sherry red or white heat and pushed into the deepest layer of the diseased part. If the punctures thus made with the cautery are very close, the entire granulating surface is transformed into one eschar, which suppuration soon eliminates. After cauterization, it is advantageous to have recourse to continued irrigation.

There are granular wounds which, during the warm season, resist the abrasions of the granulating layer, and cauterization. They go back to their former condition and last until the end of fall or even until late in winter.

In meridional countries, some of these wounds are seen to assume an ulcerous character, gradually spreading in width and depth, without being any better during the cold season. When they have resisted several successive operations, it is better to destroy the patient, if it is of little value, than to continue a treatment doubtful as to its results.

IX.

SUBCUTANEOUS WOUNDS.

Whether from accident or from an operation, subcutaneous wounds of like dimensions are much less serious than exposed wounds. The traumatic center has a temporary continuity with the outside through a small solution of continuity, but this soon becomes obliterated; the tissues are then protected against infectious agents, and if the wounding body has not infected them, cicatrization takes place rapidly, as with protected wounds. The inflammatory phenomena are slight, diminish after a few days and soon disappear; and since the skin is divided only for a short distance, the pain is moderate. Struck with the benignity of accidental subcutaneous wounds and the rapidity of

their cicatrization, J. Guerin, about the year 1840, invented the *subcutaneous* method, the value of which has been considerably diminished by antisepsis. We use it, however, for some operations, especially in plantar tenotomy, in cervical or patellar desmotomy and in caudal myotomy.

Subcutaneous wounds, which are free from infection, and have a natural tendency to heal, require simple treatment. This consists principally in closing the solution of continuity of the skin with a collodion cover, after a thorough cleansing of the region. A light compressive antiseptic dressing is sometimes useful. The wounded region should be immobilized as much as possible, to avoid the rubbing of the surfaces which are to unite the loosening of the exudation collected between them, or the irritation of the newly-formed tissue. Subcutaneous wounds of operations made in healthy tissues are always aseptic, and cicatrize by adhesive union when sufficient care has been taken. Accidental subcutaneous wounds do not always act in such a simple way; they often suppurate and may be complicated with other accidents; they belong then to the series of exposed wounds.

X.

CONTUSIONS (BRUISES).

Contrary to what is customary, we have separated *contusions* from *contused wounds*. If both are made by a similar mechanism by the action, upon tissues, of blunt, bruising bodies, and although since the beginning of the era of antisepsis, the principal clinical characteristics which distinguish them—absence or presence of a solution of continuity of the skin—is less important than in past days, among animals, they still offer sufficiently great differences to justify this division,—also taking into consideration their gravity, progress, mode of repair, possible complications and the therapeutics that they require.

Constituted essentially by a traumatic lesion—laceration, bruise or crushing of the subcutaneous tissues—without solutions of continuity of the teguments, contusions are of very varied form and gravity. Sometimes the disorders and the functional symptoms are exclusively local; at others, there are distant troubles. It is for this reason that contusions which are united on the lateral side of the head may give rise to facial hemiplegia. Nervous branches (radial, sciatic, external popliteal) may be injured on the extremities, and paralysis will be observed to follow, which lasts for a longer or shorter time.

Considered as lesions, they are divided into three classes: *contusions of the first degree*, with rupture of the capillaries of the skin or of the subcutaneous tissue and with ecchymosis; *contusions of the second degree*, with rupture of small blood-vessels, and formation of a bloody en-

largement; *contusions of the third degree*, with destruction of the tissues and more or less extensive mortification. *The primitive effusions of serosity and of liquid greasy matters* will be considered in the next chapter.

The *contusions of the first degree*, with or without excoriation of the epidermis, heal by natural processes. Rest, only, is required for the diseased part. One may, however, use with advantage, especially if there is swelling, either antiphlogistics—cold epithems, compresses wet with cold water or an astringent solution (alum water, white lotion, solution of metallic sulphates)—or slight resolutive topical remedies If pain is severe, narcotics will allay it (poultices or opiate ointments), or analgesics (cocained vaseline), and also fomentations or continued immersion in warm water. Scarifications, recommended by some French and other authors, must not be used.

For *contusions of the second degree*, more active interference is demanded. If they are recent, cold water, or salt water, applications and simple white lotions (that of alum) are useful; they hasten hemostasis and arrest the growth of the bloody tumor. Later, one should use resolutive lotions (various tinctures, camphorated alcohol), and the tincture of iodine painted over the parts; beside these, *massage* which spreads the extravasated liquid over a wider surface and stimulates its absorption; or also *methodic pressure*, made with an India rubber band, or one of linen or of flannel, if the bloody swelling is upon an extremity.

These means fail when the tumor is old and surrounded by fibrinous strata and an organized membrane,—in a word, when it is *encysted*. It is for such cases that sudden and rather strong compression has been recommended to rupture the wall of the pseudo-cyst, or puncture or incision of this wall, and irritant injections into the pouch after evacuation of its contents. For bloody tumors with clots, one should puncture with the larger trocar of Dieulafoy or that of Potain. The liquid should be expelled by methodical pressures made upon the swelling, followed by a washing of the pouch with a strong solution of carbolic acid, cresyl, or tincture of iodine; a compressive bandage should be applied, if the region permits it. When the walls of the bloody collection are thickened, already doubled up by a neo-membrane, the effusion returns; a new puncture and another antiseptic injection is required. Some hematomas contain large clots, whose exit from the cavity through a simple puncture is impossible. They must be opened with an incision sufficiently extended to permit the removal of these clots; afterwards, they are to be treated as other bloody collections. It is rarely necessary to have recourse to curetting of the walls. If suppuration occurs, the pouch must be freely opened, irrigated, and drained.

Independently of all surgical interference, contusions of the first and second degrees may exceptionally present, at certain times, well marked inflammatory phenomena and terminate in suppuration. The specific agents of the latter have reached the traumatic center, either through superficial excoriations that have denuded the papillar layer of the tegument, or by vascular channels, when the blood is accidentally infected.

In *contusions of the third degree*, the lesions are often very serious. The muscular layers are crushed, the interstices of connective structure are extensively gorged with blood; the skin soon becomes mortified, the contusion is transformed into an open wound and exposed to all the dangers of contused wounds. Recent contusions are, in general, treated with antiphlogistics, especially with continued irrigation; but warm affusions or fomentations—warm baths for small animals, or, if possible, for large—are to be preferred. When enormous extravasations exist in contused regions, puncture and antiseptic washes form a good treatment. If suppuration occurs, free opening and cleaning of the irregularities of the cavity with strong disinfecting solution (chloride of zinc 5–8) and drainage to assist the flow of the discharge, are the requirements. In contusions produced by large bodies which have moved with great force, often large vessels are thrombosed, nerves crushed, and bones fractured. One must know how to appreciate the gravity of such disorders in order to decide as to the fate of the patient.

XI.

PRIMITIVE TRAUMATIC EFFUSIONS OF LIQUID FATTY MATTERS.

These, which are frequent in heavy draught horses, less so in cattle, and which are exceptional in small animals, occupy ordinarily the regions exposed to external violence and friction, and where the skin lies, with the intervention of a conjunctive layer, upon a resisting aponeurosis. They are most often found on the haunch, thigh, stifle, over the mass of the muscles of the elbow, sometimes the withers, external face of the shank, and the hock. Their mode of formation is the same in animals as in man: they are the consequence of pressure made obliquely upon the skin, and sufficiently great to lacerate the subcutaneous connective layer; the adherences established between the skin and the aponeurosis are more or less completely destroyed; a cavity, often large, is formed, in which serosity accumulates or an oily liquid when the torn connective tissue is much infiltrated with fat. Pressure of the breeching strap, below the haunches, or on the external face of the thighs, kicks, and falls from slipping, are the principal occasional causes of the effusions observed in horses.

The subcutaneous detachment becomes filled with liquid, sometimes slowly, then again rapidly, but, in general, without noticeable inflammatory phenomena; a soft swelling, uniformly fluctuating, is formed. It seems that, in the collection of serosity, the exudation comes both from the lymphatics (lymphorragy) and from the stretched blood-vessels, allowing only the passage of the serous portion of the blood. In *fatty collections*, the pocket is filled with fatty drops, issuing from the subdermic connective tissue.

The seat of the swelling, the absence of phlegmasic phenomena or their slight intensity, the total and uniform fluctuation, clearly indicate the nature of the disease. The diagnosis presents no difficulties.

The effusion of serosity has no tendency to disappear spontaneously; when it occurs one must have recourse to active therapeutics. Among the means recommended are: puncture, and injection of iodine (Leblanc, Nocard), incision of the walls of the cavity (Leblanc, Adam, Violet), drainage of the pocket by a seton passed through it vertically or with several runs towards the most dependent point of the swelling (Neumann), and, finally, blistering applications.

Puncture with the trocar is always insufficient; it allows, ordinarily, the entire evacuation of the liquid; but in a few days, often the next, the swelling has returned. On the extremities we have also tried many times, without success, puncture, and compression with a wadded dressing. Irritant injections (pure or a diluted tincture of iodine, strong antiseptic solutions) made in the pocket after the evacuation of the liquid, not uncommonly are followed by recovery; the two opposite walls of the cavity become inflamed and rapidly adhere to each other; in the great majority of cases, however, several injections, a week apart, have to be made. When the operation is not done aseptically, the cavity suppurates and, like abscesses, must be treated by incision and detersive injections.

With vesicating frictions, the absorption of the effusive fluid is rarely obtained; it demands a long time, and often one is obliged to end the treatment by having recourse to other means.

Cauterization with spaced deep points is principally useful for old serous collections on the extremities.

Puncture, or iodine injections associated with blisters, give relief, either by giving rise, in the pouch, to modifications, which, as after the simple iodine injection, dry up the exudation; or again by starting in it a suppurative inflammation.

It is by producing suppuration that setons, inserted through the cavity, act. A fenestrated drain, secured at both ends, exposes the skin less than setons to tearings and lacerations, it better insures the flow of the pus, and gives the same results.

Extensive incision, made at the start, has the inconvenience of *expos-*

ing widely tissues destitute of all protection, in which septic elements can find a good soil. Even in former times, infectious complications were much feared: before incising, the condition of the walls of the cavity were modified. To-day, we know how to avoid those complications; and the incision of the pouch made at the dependent part, the fixing in the wound of a short drain which permits the escape of the serosity as it is secreted, and the strong antiseptic injections (chloride of zinc, carbolic acid or creolin 5 %, corrosive sublimate, 1 in 500) all constitute our best treatment. For collections of small dimensions, we ordinarily use an iodine injection or needle cauterization.

The old practice, which consisted in plugging the cavity with oakum, must be put aside. But, like Adam, one may, in some cases resort to antiseptic plugging, incise the pouch, empty it, remove the clots that it contains, and fill it with carbolated cotton dusted with iodoform.

Among cattle, one most often meets with the primitive effusion of serosity on the external face of the stifle (Trinchera, Eletti, Furlanetto).

Sometimes the serous collection appears voluminous, at others the growth is slow and gradual. In the beginning, its characteristics are the same as among solipeds: when it lasts a certain time, its walls indurate. Spontaneous absorption is observed only in recent and small collections.

It is easy to differentiate these subcutaneous sero-sanguineous collections from the hydarthrosis of the stifle.

The therapeutics is the same as in the case of horses. Notwithstanding Furlanetto recommends the application of ointment of bichromate of potassium, one may have recourse immediately to incision, apply a drain, and make irritant injections into the cavity, in preference to strong antiseptic solutions.

SECTION II.

I.

CHILBLAINS—FROST-BITES—CONGELATIONS.

The action of cold upon the organism ordinarily produces chilblains towards extremities—legs, ears, tail. It can also give rise to general troubles and sudden death.

In animals, chilblains are seen only during severe winters. During the cold season, the skin of solipeds is covered with a thick coat of hair, which not only protects them against atmospheric low temperatures but also prevents the loss of organic heat.

The horse which receives sufficient food, and which has a full hairy coating, possesses a very great resistance to cold. In Algeria, during the winter of 1845–1846, during an expedition into the mountains of

Bou-Taleb, about a quarter of the men of a regiment died from cold, while the horses suffered no accident, though they camped in the full wind. In Crimea, where the horses of this same regiment had to stand, at Kamièche, a temperature of —18–22°, it was the same (Decroix). But upon horses deprived of food, cold may produce severe frost-bites and fatal accidents.—The various breeds are not equally sensitive to low temperatures. During the Crimean war, Arabs' barb horses resisted cold a great deal better than English, and the severe winter of 1870–1871 was less fatal to African than to French horses. Clipping reduces very much the resistance of solipeds to cold (Wolf).—In cattle, chilblains of the scrotum and of the skin of the interior part of the legs are often observed (Stottmeister, Möller); they also occur on the paws of dogs and the claws, ears and the comb of fowls.

Moist cold acts more severely than dry. On that account, in all species, congelations of the extremities are much more common. The effects of long action of ice-water, snow or cold mud, upon the lower regions of the legs are well known. In horses these effects are often manifested by a more or less extensive gangrene of the skin of the coronet, fetlock or canon. We may remark, however, that this trouble is very much favored by preexisting traumatic lesions; and that, often, the cold is assisted by an infectious process (*V. Gangrenous Dermatitis*). Notwithstanding the sub-horny tegumentary membrane of the foot of horses is so well protected, it may be affected by the cold, as is proven by the facts recorded during the Russo-Turkish war (Jewsejenko). This membrane becomes inflamed and rapidly necrosed at the point of the solutions of continuity, when it is exposed on those points to the action of snow or cold mud.

There are three degrees of local frost-bites, as of burns. In the *first*, the skin is thickened and congested; in all white-skinned animals and in horses, in the region where the skin has no pigment, it is of a purplish red color and the subcutaneous tissue is infiltrated; in the *second*, the epidermis, raised by a citrine or bloody serosity, becomes loose and leaves exposed the tumefied, œdematous dermis, red brown covered with grayish ulcerations, and sometimes deeply cracked; in the *third*, there is slough of the skin, and of a variable thickness of the tissues underneath; the tegument is livid in color, covered here and and there with phlyctens, while in other places it is transformed into black or more or less discolored eschars; at times the mortification extends deeply, and the sloughing of congealed parts exposes to view tendons, bones, large vessels and synovial membranes. In a cow affected with frost-bites on the four extremities, Stottmeister saw that the dropping of the eschars uncovered bones and articulations.*

* The translator has observed cases in New York, when the practise of salting the streets after heavy snow storms was followed, where the entire skin of the inside of

Kekiler has observed a similar case in the case of a colt that had been exposed for three days to severe cold.

Congelations may be complicated with thrombosis, embolism and purulent or septic infections. When the animal resists, the region becomes covered with fungus ulcers whose cicatrization is slow, and often combined with nervous troubles (neuritis, atrophy).

During periods of severe cold, some precautions should be taken to prevent bad effects. The entire coat should be left on the lower regions of the extremities (Weber). It may be necessary to protect the animals with blankets. Proper food and exercise enable them to stand the cold well; food gives the combustibles and the muscular contraction produces the heat. Where hair is missing, or where there is a cicatrix, the skin may be covered with a greasy substance, with glycerine, vaseline or tar, which reduces the loss of organic heat and cutaneous evaporations. During thawing weather, the tissues of the lower parts of the legs should be protected from the action of cold mud by greasing the skin, the hoof and the claws, being careful, however, if the use of such applications is to last long, to clean the skin and its hair now and then by washing them with soap and tepid water.

The treatment of local frost-bites, whatever may be their degree, varies but little in its first regulations. The affected regions must be rubbed with a dry cloth, with snow or a cold liquid; and afterwards be covered with a loose dressing or bathed with tepid lotions. It is important not to use warm applications, and not to bring on immediately an active reaction; this would be followed by an intense inflammation of the tegument, and sometimes by gangrene. Exposure to the fire is especially dangerous; it has often produced the sphacele of tissues whose vitality could have been restored by proper treatment.

In frost-bites of the first degree, when the part is warmed up, stimulating lotions of camphorated alcohol or warm wine are good. If the skin cracks, glycerine, boricated or iodoformed vaseline is used.

The wounds found in the second degree are treated with glycerine, iodated glycerine, or by slight cauterizations with solutions of nitrate of silver 9%. Infiltrations of the sub-cutaneous cellular tissue need no particular attention. Punctures or incisions of the skin are injurious. If the region is much tumefied and the suppuration abundant, irrigations or antiseptic baths are recommended for this as well as burns. When the skin of a leg of a small animal or of a part of one of other animals has been frozen, no better treatment exists than a tepid water bath at 16° or 18°, the temperature being gradually raised to bring it after one or two hours to 38° (Möller).

both hind legs from the groin down had sloughed and where muscles, tendons and bones were exposed in some animals, the entire abdominal skin sloughed, in others sloughing of the feet also occurred.

In frost-bites of the third degree, when attempts have failed to restore the tissues, when they are positively sphacelated, one must wait for the dropping of the eschars, watching how it progresses and frequently washing the parts with antiseptic solutions so as to avoid the infectious complications that may occur (pyohæmia, septicæmia). Deep or very extensive sloughs on large animals demand the killing of the subjects. In the case of dogs and cats there are circumstances where amputation of a leg is performed.

In the case of animals affected with extensive or total congelation followed by general disorders, one must employ first, as in cases of local attack, friction, with snow or cold water, then dry, and stimulating frictions. Stimulants should be given internally—coffee, tea, wine, alcohol. The rapid warming by exposure to fire or by staying in a warm atmosphere is extremely dangerous. It promotes thrombosis, embolism, and fatal visceral congestions.

II.

BURNS.

The lesions produced in animals by heat and caustic substances include all degrees of gravity, from simple erythema to extensive and deep disorganizations, which kill in short time.

As the result of direct action upon the tissues, of heat or of caustics, burns may be produced by solids, liquids or gases. Those that are mostly observed in large animals are due to the combustions of solids, or of irritant gases, and are produced by burning buildings. Not only great surfaces of the superficial regions are carbonized, but warm, irritant, asphyxiating gases enter the respiratory tracts and promote a severe inflammation of the mucous membrane (coryza, laryngitis, bronchitis, pneumonia). If a great number of the animals, whose skin has thus been scorched, die, it is not the result of the cutaneous asphyxia, or of the arrest of the functions of the skin, as pretended by some authors; death is most commonly due to the phlegmasia of the respiratory membrane, brought on by the irritant action of the smoke.

Warm water, when below 100°, gives rise only to a more or less acute erythema; boiling liquids—simple water, salt water, oil especially—produce severe burns of the skin, sometimes of the mucous membranes; and the action of liquid caustics not uncommonly goes beyond the tegumentary structures. Dogs and cats are especially exposed to burns by boiling liquids. Horses and cattle are also, when they receive fumigations with too hot water (Rainard). Rey has often treated burns made by quicklime on the extremities of horses. He also recorded the case of a horse which had his four extremities deeply burnt with sulphuric acid. Fiedeler saw two horses which had accidentally fallen

in a mine upon burning scums, with their feet so burnt that even their shoes "had reddened with the heat." With most animals, but especially with horses, on which we use fire so frequently for a therapeutical object, burns of the skin are a possible and often serious accident. When the hot shoe is applied too long, on the plantar surface, during the process of shoeing, too much heat may be produced or the velvety tissue burnt. Also burns may be due to viciousness. Gohier treated a horse which had had his genital organs all burnt with flaming straw by his cruel driver to make him start a too heavily loaded wagon.

The gravity of burns depends on their extent and their depth, but above all upon the former. A circumscribed, though deep, burn seldom brings on fatal complications, while wide burns of the second or even first degree may be accompanied with congestive visceral lesions or septic accidents which kill after a lapse of time varying from a few days to several weeks. In general, when the burn has some extent, one ought, in order to give his prognosis, take into consideration the importance of the organs affected: skin, subcutaneous tissues, mucous membranes, large blood-vessels, important nervous branches, articulations, tendons and their sheaths, or organs of sense. Sometimes the lesions are limited to external regions; at others the viscera or the respiratory apparatus are affected. Pseudo-membranous coryza that Ferrier has observed in horses that had been caught in a fire, laryngitis with œdema of the glottis, and broncho-pneumonia, are accidents whose prognosis is serious. Pleuritis and pneumonia after burns of the walls of the chest, peritonitis and gastro-enteritis after those of the abdomen, have also been observed. The suppuration which results from the sloughing of the eschars is ordinarily more abundant than in most other necrotic lesions.

Burns with sloughs demand a long treatment; the sloughing of the mortified tissues generally requires from two to three weeks. The parts disorganized with fire, slough more quickly than with chemical caustics; and if a comparison be made between those, noticeable differences will be observed: the eschars of corrosive sublimate are less extensive and drop more rapidly than those of arsenious acid. On horses burnt with quicklime, Rey has had to treat extensive detachments of skin, and wounds in which cicatrization was very difficult to obtain.

From a therapeutical point of view, we may consider three degrees of burns. In the *first*, there is only scorching of the hair and slight inflammation of the skin; in the *second*, there is phlegmasia more marked and a formation of vesicles or of pustules; in the *third*, there is carbonization of the tegumentary membrane or intense inflammation of the skin, sometimes of the tissues underneath, and consecutive gangrene.

Burns of the first degree, when not extensive, demand only very simple treatment; cold aspersions, white lotion compresses of sulphate

of zinc or of iron 1 %, starch powder and other pulverized remedies. If pain is great, especially when a dog is the subject, cocained preparations must be used, to prevent its scratching or biting. Starr ointment (liq. perchlo. iron, 3 parts; vaseline 24 parts) applied at the start, quietens the pain and prevents the formation of phlyctenes.

In *burns of the second degree*, the suffering is severe, and the secretion of the vesicles gives a painful sensation. This must be allowed to escape by "pricking" the epidermis; but this loose epidermic membrane must not be destroyed, since it covers the papillary layer, insures the cicatrization of the lesion, and prevents suppuration. It is good afterwards to apply to the affected surfaces, antiseptic lotions (solution of boric or salicylic acid, 3–4 %; of creolin, 2–3 %; carbolic acid, 2 %: thymic acid, 3 %; of the Van Swieten). Ointment of iodoform and carbolic acid (iodoform, 5 grammes; carbolic acid, 10 drops; vaseline, 30 grammes), and phenicated glycerine (1 in 10–20) spread in thin coatings upon the whole surface, can also be recommended. These agents are preferable to the salts of lead, metallic sulphates, greasy substances, even the old oleo-calcareous liniments, so much recommended and used for burns of all kinds and degrees. Absorbing powders can also be utilized with advantage: starch mixed with boric or salicylic acid 5 %, oxide of zinc, tannin and iodoform. If pains are acute, one should use the solution of nitrate of silver (1 in 200); the antiseptic and analgesic preparation of Reclus (vaseline 50 grammes; boric acid 5; antipyrine 5; iodoform 1); the ointment of vaseline and salol (vaseline 50 parts; salol 4); chlorhydrate of cocaine, 0 gram 25 to 0 gram 30; or lanolin mixed with aristol (aristol 3; olive oil 20; lanolin 20). The means for restraining horses from rubbing or biting and dogs from licking should not be neglected.

In cases of burns on the extremities of large animals, continued irrigation and antiseptic baths are advantageous. In the case of dogs, long immersion of the paw in a tepid solution of carbolic acid, or of corrosive sublimate, the dusting of the inflamed surface, and a wadding dressing, form a treatment that gives us the best result. Sometimes, on large surfaces, the epidermis sloughs off, the skin suppurates, the patients undergo severe sufferings. In these cases, the use of antiseptics and analgesics is continued; if the burn is on a leg, balneation is continued longer, and made oftener; soon the pain diminishes, the cutaneous phlegmasia subsides, and the lymphangitis, when it exists, soon disappears.

For *burns of the third degree*, characterized by a true carbonization of the skin, by sphacelated surfaces, or by a gangrenous phlegmasia of the tegument and the subcutaneous tissues, two things are necessary: assist the delimitation of the burnt or mortified tissues; prevent accidents or septic complications. It is also by the use of

disinfecting solutions, irrigation or baths, and antiseptic applications in powder, or with vaseline, that these directions are fulfilled. Preparations of cocaine, morphine, or iodoform, are always useful to allay the pain. In cases where extensive cutaneous pieces are in process of elimination, this can be hurried with the bistoury as soon as there remain but little adherences.

When once the sloughs have fallen off and the wound cleansed and covered with a granulating surface, treatment of burns is the same as that of ordinary traumas. Moist antiseptic dressings are excellent; but, generally, one is satisfied by washing the granulating surface two or three times a day, covering it with a coat of boricated vaseline, or dusting it with absorbing powder (charcoal, coal-tar, boric acid, camphor, oxide of zinc). Sometimes complications exist, produced by the burn itself or brought about by the inflammation of reaction (necrosis of a tendon, of an aponeurosis, of a bone, opening of a joint or of a tendinous sheath, thrombosis of large blood-vessels, partial destruction of the principal nerves of a region). Severe burns of the legs are treated only when the diseased parts are likely to regain the use of these members. Large animals which are affected with lesions, and whose recovery must be incomplete, or end in an inferiority rendering them useless, are to be condemned at once. In the case of dogs and cats, amputation may be performed.

Serious secondary hyperæmia of the lungs, intestines, kidneys, liver, or nervous centers, and septic accidents, are indicated by significant troubles: weakness, stupefaction, coma, acceleration of the respiration and circulation, depression of the pulse, hypothermia. These are treated with stimulants (alcohol, coffee, acetate of ammonia, subcutaneous injections of ether, cafeine), and the antiseptics (sulphate of quinine, cresyl, camphor). It is sometimes useful to cover the patients with sheets dipped in an antiseptic liquid. They should be kept up on milk, and, if they still are willing to drink, cold diuretics should be added to their beverages. Animals severely burnt at fires, ordinarily, during the days following, suffer with inflammation of the respiratory mucous membrane, and, sometimes, tracheotomy has to be performed to relieve an acute œdematous or pseudo-membranous laryngitis.

Transfusions of blood and injections of salt water have been recommended against the destruction of blood-corpuscles and other alterations that may affect animals suffering with extensive burns. Whatever the condition, extent or degree of the injury, bleeding is forbidden.

Some burns require special treatment. Some of them are due to chemical substances, which must be neutralized, or the diffusion of which must be prevented. After the washing of these burns, the acids are neutralized by the alkalines, and *vice versa*. If the lesion has been made by an acid, an alkaline solution of carbonate of soda, or of potash,

is employed; if it has been made by an alkaline, an acid solution (vinegar) is used. Burns from phosphorus are treated with the hydrate of magnesia.

Cicatrices, which form where losses of substance, resulting from burns, have occurred, remain painful for a long time; and the situation of the inodular surfaces may bring on a deformation of the region. Such lesions on the legs always produce lameness, and the subjects can only be used for such services as do not require regularity of gait.

III.

INSOLATION—SUNSTROKE—OVERHEAT.

Sunstroke and *Overheat* are considered by most authors as two distinct affections. *Sunstroke* is principally a cerebral trouble, produced by the continued action of the sun's rays striking directly upon the cranium. According to the intensity of the cause, the symptoms are those of apoplexy, or of acute meningo-encephalitis. On account of their double cranian wall, whose tables are far apart, having between them vast sinuses, where air circulates quite freely, animals are less exposed than man. Bourgès, who in High-Senegal, High-Niger, and Tonkin, has been with hundreds of mules and Algerian horses, has not seen a single case, although a number of soldiers were fatally struck. The only accidents from the solar rays he observed among horses was circumscribed erythema. On the contrary, Jewsejenko says that he saw during the Russo-Turkish campaign, in Bulgaria, numerous cases of insolation among the Russian horses. All of a sudden the animal would stagger, fall on the ground, and be taken with convulsions, the temperature would rise to 43° C., a cold sweat would cover the body, and death took place sometimes in half an hour. In a dog, left for for several hours exposed in a hot sun, Benjamin observed rabid symptoms, which subsided rapidly by simple cooling applications upon the cranium. Siedamgrotzky had occasion to make the autopsy of a dog which, having been exposed to the full sun during a very hot day in July, had died suddenly: he found an abundant exudation in the meninges, with numerous small hemorrhagic centers in the brain and the medulla oblongata.

Overheating, observed principally during the summer in horses working hard at midday, and in cattle and sheep which make long journeys, seems to be brought on by the excessive heat of the whole body. The temperature may reach and go above 43° C. The animals affected show a great anxiety. The respiration is much accelerated and dyspnœic, the beatings of the heart violent and bouncing; the pulse weak, and the body is covered with perspiration. If the causes of

these troubles continue their action, the sick fall and soon die in convulsions.

Most of the subjects affected with over-heating have withstood to a high degree the influence of the solar radiation, and, in the generality of cases, one is in the presence of a complex morbid state in which, according to the given troubles prevailing, three forms can be recognized: 1. *Cerebro-spinal*, essentially characterized by signs of a great hyperæmia of the nervous centers; 2. *Cardiac* and *syncopic*, killing by arrest of the heart; 3. *Pulmonary*, characterized by anxiety and excessive dyspnœa, which kills by asphyxia.

Dogs fixed softly in wooden frames and exposed to the sun when the heat was 25° to 28° in the shade, taken after three-quarters of an hour with trepidation and chronic convulsions, become comatose and die quickly. (Vallin, Vincent.)[1] By over-work, experimentally realized in making animals walk on a mobile wheel placed in a room heated 50° to 60°, death takes place after an hour or so. (Laveran, Reynard)[2].

The experiments made by Colin upon large animals have shown that if, by exposure to the sun, the hyperæmia of the superior regions of the body takes place with rapidity at a degree somewhat elevated, the central temperature rises only slowly and in very limited proportion. On the contrary, in the case of small animals, the central heat reaches quickly the degree incompatible with life. The wool of the sheep does not protect him from heat any more than from cold; in animals of this species which were experimented on in a yard surrounded by very warm walls, the central temperature did not rise much above 41° C. In conditions where accidents from overheating take place, the hyperæmia does not result except from the outside temperature: it is due also to the superexcitation of animal caloricity, resulting from muscular action, respiration, and other fundamental modifications. Overheating has numerous degrees and various forms, according to its effects upon a larger or smaller number of functions or of organs. It may extend to cerebral congestion, cerebro-spinal congestion, or to other visceral congestions to incipient asphyxia, anesthesia, syncope, and to other troubles which invite rather than exclude each other.[3] (Colin.)

Prophylactic rules are suggested by the etiology. Animals must not be submitted to long exposure under a burning sun, or to excessive work in a high temperature. If they must work under a burning sun, their heads ought to be protected with leaves of trees, a cap, or other objects *ad hoc*. In Bulgaria, as soon as the heads of Russian horses

[1] Vallin, Bullet. Acad de Med., 1894, p. 640.

[2] Laveran & Reynard, Bull. Acad. de Med. 1894, p. 501.

[3] Collin, Bull. Acad. de Med., p. 28.

were protected with linen caps, there were no more deaths. (Jewsejenko.)

Curative treatment consists in immediate, and, for a time, continuous care. The animal should be placed in the shade or a cool place, if possible. Bleeding is especially advantageous for the pulmonary form. Asphyxia will be prevented by subcutaneous injections of ether (10 to 20 grammes for large animals; 1 to 2 for small); they should be renewed after an hour; if necessary, artificial respiration should be maintained. In the cerebro-spinal congestive form abundant affusions of cold water on the head and neck are recommended, with flagellation and revulsive friction on the legs (spirits of turpentine, mustard). To lower the temperature, cold irrigations on the body, friction with crushed ice or cold rectal injections are advisable. If an improvement is manifested, and all danger seems at end, one should have recourse to remedies which will prevent the return of the congestive accidents and stimulate the elimination of organic wastes, which are the causes of those accidents: injections of caffeine alone or combined with those of ether (caffeine 4 grammes; salicylate or benzoate of soda, 8 grammes; distilled water, Q. S. to dissolve and make 20 cubic centimeters; give one gramme of caffeine by injection to large animals, 5 or 10 centigrammes to small); injection of pilocarpine (20 to 30 centigrammes in the case of large and 2 to 4 in the case of small animals).

IV.

ACCIDENTS FROM LIGHTNING.

Accidents from lightning occur to all species of domestic animals, but more commonly to large, especially those that live in pastures. According to the intensity of the action of lightning, whether it acts directly or by *reflex shock*, its effects vary. Sometimes animals are killed on the spot—some keep the position they had when struck; others are thrown on the ground and remain there senseless. There are some which rise almost immediately, exhibiting afterwards only signs of stupefaction, which pass off little by little (Roloff); we have seen a dog thrown on the ground by a shock get up after a few minutes and return to his normal state. It showed signs of weakness and of fright, but they gradually disappeared. With others, the loss of the senses may last several hours; and often serious troubles remain (exaltation of sensibility, a stumbling walk, paresis, paralysis, hemiplegy, paraplegy). Blindness is frequent. (Jarmer, Fischer, Ziegenbein.) In numerous cases, where animals have been fatally struck, a flow of blood from the mouth and nostrils has been seen.

Some animals struck by lightning present no external lesion (Roloff, Hering, Boellmann); but, ordinarily, the surface of the body shows

circumscribed or extensive burns, regular or irregular. The skin is marked with lines or narrow bands, angular or in zigzag; sometimes the hair is destroyed upon wide surfaces. In piebald cows, Urbain has seen the burns affecting only the region covered with white hair. Deep burns of the dermis, of the subcutaneous connective tissue, and of the muscles have been observed. In general the high regions of the body are affected—the head, neck, and withers.*

When lightning strikes a building containing a certain number of animals, some standing, others lying down, it is quite often the former that are seriously or fatally affected. In a stable of nine horses, four that were lying down escaped and the others were struck; two were killed on the spot, two remained blind, the fifth was paralyzed (Ziegenbein.) In a barn in which there were seven cows and a calf, the calf became lame only; all the cows were killed. In 1883, in the stud of St. George's, six thoroughbreds were struck with lightning. The stable included six compartments arranged in two rows, and each contained two horses; the lightning killed the animals of the first and sixth compartments; spared those of the second, and killed one in the third and one in the fifth. No trouble was observed on those surviving, except two seemed to be somewhat stupefied for a day (Garcin). Sometimes the victims are more numerous: in 1892, at Alhowa, near Munster, lightning killed 300 sheep returning to the sheepfold.

Electric discharges are liable to produce in animals serious and, at times, fatal accidents. Woherling records two cases of this nature; a horse, harnessed to a cab, while trotting, fell down a few moments after passing over a metallic plate covering the electric light wires; it exhibited numbness and muscular tremblings, which subsided in a few hours. A mare passing over the same plate fell suddenly, killed. There was no burn on the surface of the body; at the *post mortem* examination the heart was found flabby and the lungs and nervous centers congested.

The principal accidents for which one may be called upon to interfere are: paralysis (Roloff, Barenbach, Dehaye, Ziegenbein, Steffen); cramps (Curdt); burns (Curdt, Roloff, Urbain, Hering, Meyerheine, Lucas); phlegmasia of mucous membranes (Boellmam, Curdt); ocular lesions (Boellmann, Lehnhardt).

When the animal is still lying on the ground, incompletely restored to itself, one must try to revive its forces by dry or irritating frictions,

* Liautard writes on the effects of lightning on horses the result of a thunder storm striking a breeding establishment, where one stallion remained unhurt and another, Pancoast, was found "prostrate, lying in a heap on his off-side, with profuse epistaxis from both nostrils;" he exhibited symptoms of general paralysis · the left side of the head was principally affected. He ultimately recovered. (American Vet. Review, vol. 12, page 202.)

cold aspersions, stimulating drenches (alcohol, coffee, carbonate of ammonia) or subcutaneous injections (ether). Burns, cutaneous and mucous phlegmasia, paralysis, and ocular accidents are treated according to the rules laid down for the therapeutics of these affections. Often the affected cutaneous regions affected assume a peculiar aspect. Sometimes hair grows no more. (Urbain.) Upon a cow treated by Müller, the burnt region, which extended from the left flank to the tail, became covered with a thick epidermic horny-like layer.

CHAPTER III.

COMPLICATIONS OF TRAUMATIC LESIONS.

I.

SYNCOPE—SHOCK—LOCAL STUPOR.

Traumatic syncope is a serious accident, appearing suddenly, and characterized by arrest of the beatings of the heart and a condition of apparent death.

In all species, one may observe *mechanical syncope*, by cerebral anæmia, due to a very abundant hemorrhage and to the depletion of the circulatory system.

Reflex syncope is very rare in animals. Goubaux has recorded one case seen at the clinic of Bouley. It was in a very delicate and impressionable dog suffering from a tumor of the abdominal walls. While this was being excised without sensible loss of blood, or compression of the respiratory organs, the animal was seized with a mortal syncope. (*) We have observed a similar case in a slut from which we were removing a tumor of the ventral mammal. We also witnessed another in a mare during ovariotomy; the puncture of the vaginal walls and the enlargement of the wound had been done without incident; at the moment when the hand entered the abdominal cavity, the animal made very violent expulsive efforts; scarcely had the removal of the first ovary begun when she staggered and fell lifeless: the respiration had stopped, the beatings of the heart were no longer perceptible, the reflexes were gone. Artificial respiration and titillation of the tongue having been made, after a few minutes, the movements of the ribs and of the heart reappeared.

Mechanical syncope may be prevented by avoiding a large loss of blood. The treatment for both forms is that of syncope in general: place the head in a dependent position, excite the skin by flagellation to stimulate the return of the cardial movements, practice artificial respiration, make tractions upon the tongue, and inject ether subcutaneously.

The *traumatic shock*, *lethargy*, or *stupor of the wounded* is a condition of collapse which differs from syncope in the fact that the beatings of

(*) Goubaux—Rec. de Med. Vet. 1885, p. 220.

the heart and the pulse persist. A reflex condition produced by a kind of commotion upon the nervous centers, the *shock* is often but the first step towards fatal coma.

The wounded, upon which it is observed, should be left in costal decubitus with the head dependent. They should receive irritating cutaneous friction, alcohol or ether in hypodermic injections, and stimulating douches.

Local *stupor* or traumatic local commotion, a peculiar condition observed with contused wounds, is characterized by anæsthesia, the absence of hemorrhage and the cold sensation received by feeling the edges of the wound. Sometimes it exists alone, at other times it is accompanied with the general phenomena which constitute the traumatic shock. Round the wound there exists a benumbed zone, ordinarily extensive, which has a great tendency to mortification.

The treatment must have for its object the prevention of this, the arousing of the circulation, and the restoration of vitality to the anatomical elements. Stimulating and tepid antiseptic lotions are particularly to be recommended. As long as the local stupor lasts, all surgical interference must be stopped, except in case of positive emergency.

II.

HEMORRHAGE AND TRAUMATIC ANÆMIA.

The abundant and continued hemorrhages that are observed with some traumatic lesions in animals, are not always in proportion to the caliber of the blood-vessels divided. Whether *primitive* or *secondary*, and in the latter case, *precocious* or *tardy*, they may result from an alteration of the vascular walls, a general morbid condition (leucæmia, hemophilia) or from various visceral affections (diseases of the liver or of the heart). Their effects depend upon numerous conditions: duration and quantity of the hemorrhage, its local or general cause, caliber of the injured vessels. With the exception of patients suffering from leucæmia or *adenie*, it is extremely rare for animals to have fatal traumatic hemorrhages, unless the injured blood-vessels are of great dimensions.

The means to use in these cases vary accordingly. The flow of blood from small blood-vessels ordinarily subsides by plugging, pressure, or cauterization. For large blood-vessels, ligature or the torsion is used. (See *Hemostasis*).

Traumatic anæmia is the consequence of the loss of a large quantity of blood. Sudden and considerable hemorrhages give rise to *acute anæmia*; less abundant but repeated flows bring on *chronic anæmia*.

The complete obliteration of the bleeding vessels is, in all cases, the

first matter for interference. When anæmia occurs suddenly the serious symptoms which appear indicate an imminent syncope, which must be prevented by placing the head of the animal in a dependent position, and practising flagellation and artificial respiration. Hypodermic injections of ether are also recommended. If one succeeds in bringing the subject to, water should be freely given to satisfy the great thirst which it will exhibit. Well-regulated hygienic measures, heavy feeding and tonics will be sufficient, generally, for a complete recovery. When once hemostasis is assured, tonics and abundant feeding must be resorted to in cases of chronic anæmia.

III.

TRAUMATIC EMPHYSEMA.

Produced by the infiltration into the cellular tissue of air or of gas from the digestive tracts, traumatic emphysema is characterized by a soft, circumscribed or diffuse tumefaction, crepitant and painless. It is quite frequently observed as a complication of narrow penetrating wounds of the nasal cavities, sinuses, larynx, trachea, lungs or costal walls; and also has been seen after wounds of the larynx, which were made through the mouth, in rough manipulations to push forward foreign bodies arrested in the œsophagus (Barbotte) : under the influence of the respiratory movements, the air enters the subcutaneous or submucous cellular tissue, spreads little by little, and makes the characteristic crepitating tumefaction. Wounds of the axilla or of the groin, and some peri-articular solutions of continuity, are often accompanied with it and sometimes with general emphysema. The patient mentioned by Bouret had a wound on the inner face of the elbow : he became enormous, monstrous; his limbs had the size of a child's body; his body was as if it had been inflated ; the neck and all the superior and posterior parts of the head were in this condition. In these wounds of the axilla and of the groin the edges of the solution of continuity separate by the motions due to abduction of the leg, the air enters by a kind of aspiration ; and by a motion due to adduction, it is squeezed into the connective tissue of the surrounding parts. Analogous phenomena take place with peri-articular wounds.

The subcutaneous emphysema of sheep, quite frequent in animals traveling in flocks, is almost always the result of penetrating bites on the neck ; the trachea opens, the air is pushed into the subcutaneous connective tissue by the action of the lung, the emphysema appears successively in the throat, the cheeks, forehead, and round the eyes ; it extends to other regions where the looseness of the cellular tissue permits the progression of the air, and in a few hours is generalized

(Godbille). In tympanitis, if one punctures the cæcum in horses or the rumen in cattle, as also in accidental wounds of those cavities, gases, which they contain, penetrate sometimes into the subcutaneous connective tissue and produce a more or less extensive emphysema.

Subcutaneous emphysema may exist without a wound of the skin or of the superior respiratory organs. In cattle, it quite frequently coexists with pulmonary emphysema, sometimes with echinococcosis or other pulmonary lesions. Then, generally, it begins at the superior part on the neck; ordinarily, not very apparent at the outset, palpation is necessary to detect it. Then it spreads towards the posterior regions, following the dorso-lumbar line.

Sometimes subcutaneous emphysema shows itself upon animals which are not affected with pulmonary lesions and in which the skin is free from the perforation of œstri. This form is ordinarily observed upon animals which have made a long journey on foot. Cattle dealers say that over-walking, fatigue, and blows are the cause of it. The gaseous infiltration starts almost always at the loins, extending afterwards to the back and the withers. Lafosse admitted that under the influence of a trouble in the cutaneous respiration, these gases (oxygen, carbonic acid, nitrogen) were "thrown into the cellular tissue by the capillaries." Bouley had to make a fissure in the rectum with a puncturing foreign body to produce it. A gaseous elaboration of microbian origin has also been cited as cause.

The slight gravity of traumatic subcutaneous emphysema is recognized by numerous observations. The action of the air upon the cellular tissue is almost without danger, and that of gases issuing from intestinal sources is not to be feared, unless they carry with them, in the connective tissue surrounding the wound, a certain quantity of liquid matter noxious on account of the microbes it contains.

The treatment is the very simplest. Traumatic emphysema due to atmospheric air should be treated by methodic pressures made upon the tumefaction, from the periphery towards the wound, to expel the air which has penetrated the tissues. If the cutaneous wound is small, it should be obliterated with a plaster of collodion. Large wounds of the axilla and of the groin should be partially closed with a suture and the patient should be kept at rest. With large penetrating wounds of the trachea, when the air reaches the connective tissue through the wound of the mucous membrane it is necessary to enlarge the cutaneous solution of continuity, whose small size is, ordinarily, the cause of the emphysema. In these first varieties of the affection, no puncture or scarification of the crepitating zone is to be made. When emphysema is produced by gases from intestinal cavities, the cutaneous wound must be enlarged, methodic pressures must be made on the swelling, and if the inflammation of the peritraumatic zone indicates the presence, in

the tissues, of irritant infectious liquids, scarifications and antiseptic injections must be made. Emphysema of sheep can be avoided by smoothing the canine teeth of dogs which watch the flock. When a bite is already accompanied with emphysema, a free cutting away of the skin, at the wound, will prevent its spreading.

The benignity of essential emphysema is like that of localized emphysema. It ordinarily disappears in a few days, sometimes even in a few hours. Massage is useful. Scarifications, recommended by Lafosse, are superfluous.

IV.

THROMBOSIS AND TRAUMATIC VENOUS EMBOLISM.

Any vein enclosed in a traumatic center is exposed to thrombosis; inflammation may affect its walls, alter its endothelial layer, and thus produce coagulation of the blood in the blood-vessel; if the walls have been injured, thrombosis almost always starts immediately. Sometimes the clot increases gradually, obliterates the vessel, and extends forward even to the first collateral (*obliterating thrombosis*); at other times the coagulation remains still and the canal is yet permeable (*parietal thrombosis*). When the diseased vein is enclosed in a non-infected traumatic center, the intravascular clot is also aseptic. It is habitually infected in venous thrombosis which occurs in suppurating wounds.

In general, aseptic clots quickly adhere somewhat intimately to the walls of the blood-vessel; they are soon infiltrated with embryonic elements, and become the seat of an organization which ends with the obliteration of the vein by a fibrous tissue continuous with the vascular walls. Sometimes it happens that they disintegrate; portions may get loose from their central extremity, continuously struck by the blood at the very point where the circulation is still going on.

It is thus that, *emboli* or *erratic clots* are produced, which, carried by the blood, go to produce infarction in the lungs, by obliterating the small divisions of the pulmonary artery. Unless voluminous, aseptic emboli give rise to troubles, not serious, beginning in hyperæmia and ending in sclerosis of the thrombotic pulmonary territory. What makes the gravity of traumatic thrombi, or of the emboli that get loose from them or of the infarctions which produce them, is *infection*. *Septic* or *malignaut* emboli carry into the lungs infectious agents with various virulency which give rise to metastatic abscesses or to centers for gangrene.

Voluminous emboli sometimes close a principal branch of the pulmonary artery; at others, they are arrested by the valvular cords of the right ventricle. Whether aseptic or infected, they suddenly provoke serious troubles, sometimes death in a few moments.

When an important vein is enclosed in a traumatic center or included in its walls, and by this fact exposed to thrombosis; and when the latter is already realized, one must insure the immobilization of the region, avoid explorations and useless pressures, attend to the correct application of the dressings or necessary bandaging, and prevent the phlogogenous action of the secretions of the wound and of the pus upon the venous walls. Such are the general requirements. With puruient thrombosis of some superficial veins, immediate ligature, made aseptically at some distance from the morbid center, is the surest way to prevent infectious complications.

V.

TRAUMATIC FEVER.

The febrile reaction which occurs in subjects wounded and operated upon is due sometimes to absorption, from the traumatic center, of pyrogenous or septic substances (traumatic fever proper), at others, to a secondary local affection or a diathetic determination, both provoked by the wound (epitraumatic fever).

Ordinary traumatic fever appears, generally, the second or third day, reaches a variable degree of intensity, according as it is *aseptic* or *septic*, remains stationary for two or three days, then gradually subsides, to disappear from the fifth to the eighth day. After accidental wounds or those from operations made in infected tissues, it often manifests itself in twenty-four hours, the pyrogenous substances of the wound being immediately absorbed. Although the fever is slight with traumas which cicatrize by first intention, it is sometimes severe when the wounds are extensive, deep and suppurating, and when violent inflammatory phenomena occur, due to the presence of a body foreign to the wound, to a necrosis, or a local gangrene. Any complication which occurs in a trauma is, in general, indicated by a sudden ascension of the thermic curve and an increase of the other phenomena of reaction. The theory which explains traumatic fever by the absorption of the inflammatory or septic products, to-day universally adopted, is based upon the following data: the pullulation on the wound of various microbes, in particular of the agents of suppuration, brings on the elaboration of pyrogenous leucomaines absorbed by the tissues;—with antisepsis, there is no traumatic fever, or it is very weak; when it is observed in wounded animals whose wounds cicatrize by first intention, protected by antiseptic dressings, or after subcutaneous lesions, it is almost always slight;—in animals, septic traumatic fever is indicated by a hyperthermia of two or three degrees; in aseptic febrile reactions, the mercurial column does not rise much above 39°. Notwithstanding the results obtained by the well-known expcriment of Claude Bernard from the deep puncture by a

street nail made on a horse's foot and other researches of the same kind, the part which the nervous system plays in the genesis of traumatic febrile action is secondary.

The prophylaxis of surgical fevers depends altogether upon antisepsis. With it we can, henceforth, screen our patients operated upon and our wounded from those intoxications, considered in days gone by as fatal, which result from the absorption of putrid liquids collected on the exposed wounds or under the dressings. All operation on healthy tissues, performed aseptically, ought not to be accompanied by other than benignant phenomena of reaction and a moderate hyperthermia. If it is made on inflamed, suppurating tissues, one should reduce to the minimum the febrile manifestations, by minutely disinfecting the wound and its surroundings (washings, baths) previous to the act of operating; the diereses made with the red hot wire expose these lesions less to absorption of putrid matter and to intoxication than those made with the bistoury. Nothing demonstrates more forcibly the influence of antisepsis upon the degree of the traumatic pyrexia in animals than a comparison of the thermic curves taken upon subjects of an operation whose wound had been covered with a wadded dressing, or with one of oakum not disinfected. We may remark, however, that even in operations and dressings made as they should be, one does not always succeed in preventing a somewhat marked elevation of temperature. At times, with subjects whose general condition and the great functions are scarcely disturbed, one will observe thermic ascensions which reach 1.5°, without manifest complication from the wound, but these cases are exceptional; general troubles are ordinarily in proportion to the hyperthermia; and when the mercury reaches 39.5°, it is wise to remove the dressing and look. For the same reason, if the fever does not subside by the eighth or the tenth day, often, there is an accumulation of pus or of putrid serosity in the wound, when a local gangrenous or necrotic complication has not already taken place. The irrigation of the trauma with an antiseptic solution (carbolic acid, creolin or chloride of zinc) is sufficient to lower the temperature, sometimes to bring it back to a figure close to normal.

With exposed wounds, the same result may be obtained by disinfection, and free escape of the secretions, draining, and the use of absorbing powders. The flow of the liquids being insured, if the fever continues to be high, all there is to do is to increase the antiseptic washings and watch the surroundings of the wound; sometimes the phlegmasia is very high, at others a phlegmon or lymphangitis is developing.

The internal treatment is that of fever in general. We generally prescribe only slight purgative alkalines. Surgical fevers, however, being attenuated forms of putrid intoxication, it may be a good thing, if they are severe, to have recourse to antiseptics and antipyretics

(salicylic acid, creolin, camphor, antipyrine). In some cases the weakness and depression of the animals will have to be treated with stimulants (coffee, alcohol, ether).

VI.

TRAUMATIC ERYSIPELAS.

Erysipelas is scarcely ever observed in animals. It is, however, an infectious complication of wounds, produced by a *streptococcus* considered at first as a specific microbe. The infectious agent penetrates the walls of the wound, reaches its cavity little by little, progresses into the lymphatics, at times promotes phlegmous or local gangrenous accidents, and may even produce serious general accidents, fatal serous or visceral phlegmasia. Ordinarily, erysipelas is a complication of recent wounds of the skin and of the mucous membranes; it is with contused wounds, burns, and lesions resulting from some cutaneous diseases (acne, eczema, follicular mange) that it is observed most commonly; but any solution of continuity of the skin is favorable to its development; a simple excoriation is sufficient for its appearance. It also often appears with wounds already granulating, when this protecting cover is accidentally torn; it is thus that erysipelas is seen with ulcers, suppurating wounds, or old fistulæ (auto-inoculation).

The pathogenous element has been isolated in man by Fehleisen. It is a streptococcus arranged in double chains, which grows well on gelatine and on agar, where it forms whitish colonies. It does not liquefy gelatine. Most barteriologists doubt its specificness, and claim that it is the ordinary streptococcus. To this, it is objected that the inoculation of pure cultures of the streptococcus of Fehleisen promotes erysipelas with or without lymphangitis, while the ordinary streptococcus engenders phlegmons especially. But it is now known that the streptococcus, like many other pathogenous germs, may promote diverse affections, very different troubles according to its actual degree of malignity or of virulency. Very often the agent of erysipelas does not act alone; it is associated with other microbes, most frequently with staphylococci. The disease is contagious and is easily transmitted by the hands, instruments, and materials for dressings. Before antisepsis, before the researches which have definitively proved its infectious nature, it has frequently been seen prevailing as an epidemic in hospitals for mankind. In veterinary practice, a great number of affections have been described under the name of erysipelas. The reading of the published observations shows that under this title have been ranged: the erythemas produced by the sun or the eating of buckwheat, the cutaneous quittor, anthrax, rouget and even eczema. With the excep-

tion of a few recent facts, all were falsely named, or they do not possess the stamp of exactitude demanded in scientific researches. No doubt, however, erysipelas exists in animals. It is inoculable by subjects of our domestic species; Fehleisen has studied it experimentally on swine and on rabbits; Möller, Hoffman, and Lucet have seen it on the horse; Rychner and Lucet on cattle; Fröhner on dogs (4 cases only out of about 70,000 patients).[1] We ourselves have seen it several times on horses and in dogs. The principal characteristics of cutaneous erysipelas, since they are concealed by the hair, and, in the case of the horse, by the pigment of the skin, are much less evident than in man. That is why, in veterinary practice, it has been mistaken to this day with phlegmon, lymphangitis or the septic processes. In general, it seems less serious in animals than in man; fatal cases, however, have been noted in the case of dogs and solipeds. Upon the horse of Lucet, erysipelas acted like septicæmia and killed it in forty-eight hours.

The *prophylaxis* of erysipelas from operations is that of all infectious accidents which may complicate wounds made by the surgeon. Operate quickly, take all antiseptic precautions, protect the wound against post-operatory infection. Those are the means. But it is not so easy to prevent them with old accidental wounds, infected and suppurating. Although these can be cleansed, even their dressings renewed without tearing the granulations when they are enlarged or treated with the bistoury, new roads of entrance are necessarily opened to the micro-organisms. The chances of infection will be reduced to the minimum by previously washing the granulating surfaces and excising them with the red-hot cautery.

When the erysipelas is developed, the treatment must be local and internal. If it is limited to the peritraumatic zone, tepid carbolic or corrosive sublimate solutions, used as lotions, irrigations, baths or nebulizations, according to the case, then followed by applications of boricated or cocained vaseline, are almost always sufficient to prevent its extension—often they have a beneficial action on the general condition; and soon the temperature lowers. The same treatment should be carried out if there are phyctenes or lymphangitis. With erysipelatous wounds of the extremities, combined with lymphangitis and diffuse swelling of the extremities, long antiseptic baths (solution of corrosive sublimate, 1 in 1,000, or of carbolic acid 2 %, are very advantageous.

Phlegmonous erysipelas must be treated more actively. When a severe œdematous tumefaction announces the inflammation of the subcutaneous connective tissue, one must make, over the whole involved

[1] Fröhner, Berlin, Thierarztl Wochurschr, 1894, p. 368.

surface, scarifications or deep cauterizations which permit the exit of the inflammatory exudation and open to antiseptics admission to the deep layer of the dermis, the subcutaneous region and the lymphatic radicules where streptococci are numerous. As soon as fluctuation indicates the presence of abscesses in the neighborhood of the wounds, along the lymphatic vessels or in their glands, these abscesses must be immediately opened and treated antiseptically. Diffuse swellings, which sometimes occur on the legs, should be carefully watched, and if the formation of deep abscesses is suspected they should be probed with fine punctures. Scarifications or deep point firing, tepid antiseptic irrigations or baths are still the best means to prevent gangrene of highly inflamed tissues; if, however, sloughs take place, the treatment should be completed by that for moist gangrene.

Complications of the viscera, of the large serous membranes, and of articulations are treated by methods especially marked out for each of those.

Slight cases receive for general treatment tonic douches, light purgatives or alkalines. The other cases receive antiseptics, alcohol, extract of cinchona, and sulphate of quinine, according to the species under treatment.

VII.

PURULENT INFECTION—PYOHÆMIA.

Produced by the penetration of pyogenic microbes into the circulation and their diffusion through the organism, *purulent infection—pyohæmia*—is a complication of suppurative wounds. While septicæmia is ordinarily a precocious accident of traumas, pyohæmia is a late episode of the same, but not the less dangerous. Likely to occur in all species, particularly common in horses, rather rare in dogs, swine and sheep, it is exceptional in cattle, goats and birds.

It may break out at any moment with extensive, deep, anfractuous wounds, which suppurate abundantly; with sinuous fistulæ, having several tracts which present necrotic lesions of synovial membranes, tendons and bones; with suppuration of the synovial membranes; or with suppurative inflammation of the veins or of the lymphatic trunks. In horses, phlebitis of the jugular, poll-evils, disease of the withers, tendinous quittor, purulent arthritis and synovitis, gangrene of the tegumentary membrane of the foot and the caries of the *os pedis* are the surgical affections which are mostly accompanied by it. Independently of the ordinary purulent absorption, there exists in that species specific pyohæmias related to some infections (distemper, glanders). In cattle, it has been observed as a complication of extensive suppurating

contused wounds; most commonly, it has as starting point several external phlegmasias related to some infection and carrying with itself gangrenous or necrotic lesions (aphthous fever). The same thing occurs in small ruminants. In dogs, its ordinary causes are complicated fractures, crushings, and other traumatic lesions of the bones of the extremities. In young animals of any species, more especially colts and calves, it is almost always due to the suppurative inflammation of the umbilical vein, *phlebitis of the cord.*

Its etiology consists in the *existence of a suppurating trauma*; several conditions, however, inherent in this, in the wounded subject, and in the surroundings, promote its development; these are especially: the depth of the wound, its anfractuous conditions, the underminings in which the pus collects, the generally bad state of health, the heaviness and the overworked condition of the patient, the want of ventilation and defective hygienic surroundings in which the animal is placed.

Purulent infection is produced by the ordinary microbes of suppuration, generally streptococci or staphylococci. The most constant of those, the one that plays the greatest part, is the ordinary (vulgar) streptococcus. It acts alone or in concert with staphylococci. It is known that the latter possess various degrees of virulency, and that, alone, they may give rise to pyohæmia; but cases of this kind are rare. In three cases of purulent infection studied by us from the bacteriological point of view, we have twice found streptococci and once associated with staphylococci.

How do those microbes reach the blood? By what mechanism can they promote the metastatic abscesses and the other lesions of pyohæmia? The mode of infection, very different in different cases, is often complex. With suppurative phlebitis, infecting emboli may get detached from the intra-venous clot which is infected with pyogenic microbes, and be carried by the blood into the lungs and other organs. Within the walls of fistulous tracts, due to and kept up by necrotic lesions (disease of the withers, of the neck, tendinous quittor), there exist phlebitis and lymphangitis from which the infection may start. Without phlebitis in old suppurating wounds the granulating surface may be torn; "the wound is wounded" in one place; there the tissues are no longer protected by their guarding cover, and the blood and lymphatic vascular canals are open to the agents of suppuration. The modifications presented by purulent infection in its mode of expression, its march and gravity, are especially due to the variable virulency of the microbian species which produce it.

The *propyhlaxis* demands the same general precautions as that of septicæmia. It is by the wound that the pyogenic microbes penetrated into the economy; so that careful attention must be given to the wound to prevent infection. With wide, deep, irregular wounds, one

must avoid the stagnation of the pus. Frequent antiseptic washes and continued irrigation are the best means to use. Often enlarging incisions, counter-openings and drainage have to be made; though one ought, in a general way, to avoid the wounding of granulating layers; there should be no hesitation, however, if the case is urgent. The red hot iron, a sharp or a long pointed cautery, is better than the bistoury: the eschar remains adherent to the tissues underneath until they are lined with granulations, the penetration of the micro-organisms cannot take place as upon bleeding surfaces. The washings should be completed by irrigations with an antiseptic solution, sufficiently strong to destroy the germs still adherent to the granulations.

For anfractuous wounds, carbolic or corrosive sublimate nebulization are very advantageous. If they exist on the legs, long tepid antiseptic baths of twenty minutes or half an hour and repeated several times a day should be prescribed. Antiseptic or simply absorbing powders may also be useful.

Attention to hygiene should not be overlooked: spacious, well ventilated, moderately warm locality; food of good quality: for weak patients, if appetite remains, abundant feeding, milk, tonics, a stimulant (alcohol, hay tea).

The outset of pyohæmia is slow. Often the wound is but little changed; the granulations are pale, soft, flabby, and suppuration is less abundant; but there is no other prominent symptom, no diffuse tumefaction, no œdema. As to general disturbances, they are those of a strong traumatic fever, with febrile rushes, chills, sudden thermic risings, inappetency, dulness, a kind of typhoid condition with dull coloration of the mucous membranes and an irregular pulse; their meaning is positive, even when the patient has been previously under the influence of a more or less marked febrile reaction. To inspect the wound, enlarge it, cleanse it well, sponge its cul-de-sacs with strong disinfecting solution (chloride of zinc, carbolic acid, corrosive sublimate), dust it with iodoform and irrigate it continually with cold water. This must be done at once.

Cautery is useful to destroy the fungus granulations which conceal putrid centers, and to reach the infectious germs deep down. To try to "render the wound aseptic," as advised by some, is evidently an illusion; but it must be purified as much as possible. If purulent superficial collusions appear, they must be opened at once and treated as ordinary abscesses.

The internal treatment, most uncertain in its results, consists in the administration of agents able to build up the strength, impede the pullulation of the microbes and neutralize the effects of their toxines. Among the numerous substances recommended, those that are most used are: alcohol, coffee, sulphate of quinine, carbolic acid, creosote, creolin, spirits

of turpentine, and salicylate of soda. They are introduced mostly through the digestive mucous membranes (mouth, rectum), some by hypodermic injections (carbolic acid, sulphate of quinine). It is better to administer them under the form of rectal injections than by force through the mouth. Lately, hypodermic and intravenous injections of weak solutions of corrosive sublimate have been tried for man. While the first proved insufficient, the intravenous injections (30 to 40 milligrammes of corrosive sublimate in 8–10 injections) by the method of Bacelli, have given Kermarsky several successes. It is a method which might be tried with animals. The patient should be kept up on tonics, milk, hay-tea, and soups. If anorexia is present, nutritious rectal injections should be given.

The same as for septicæmia, when already the organism is thoroughly infected and intoxicated, whatever antiseptics are used, and no matter what is the dose or the mode of administration, the bacterians still triumph. There is chance of success only at the beginning of the infection. As proof of the possibility of recovery from pyohæmia, facts, it is true, have been mentioned in which, at the post-mortem examination of some horses, caseous purulent centers, disseminated through the viscera, were found ; but a close study of these facts shows that they were of tuberculous or glanderous nature, and due to chronic purulent injection. We do not know that, up to this time, authentic cases of the cure of confirmed pyohæmia in horses, as expressed by the clinical signs which announce visceral infection, have ever been reported.

VIII

SURGICAL SEPTICÆMIA.—TRAUMATIC GANGRENE.

A formidable complication of traumas is surgical septicæmia, an infectious, microbian disease, produced by the *septic vibrio* or *bacillus septicus gangrenus.*

All animal species are subject to it, but all are not equally liable ; and in each species, all the individuals do not possess like aptitude to contract it. It is most frequently observed in horses, less commonly in dogs, swine, and ruminants ; among the latter, cattle are only exceptionally affected.

Old surgery had clearly mentioned the condition in which traumatic septicæmia occurs. It was known that recent wounds, contused, irregular, with crushed or sphacelated borders, were principally liable to it. The dangerous influence of overcrowding, limited quarters, close air, and atmosphere vitiated by agglomeration of the sick were all recognized. It is nearly a century since Barthelemy and Dupuy made the first experiments at Alfort to threw light on the pathogeny of this

disease in the cases of horses. In 1840, Renault, after having insisted upon the dangers of the exposure of wounded tissues, incriminated, as conditions of its development, the presence in wounds of clots of blood, of mortified tissues, of putrefied organic matter, and the contact of those clots and of those tissues with the warm, damp atmosphere, loaded with the " miasmas " of putrefaction. After Bottini had demonstrated its transmissibility, it was no longer disputed that the infection is carried, especially to accidental traumas, not by the air, but by solids and liquids, by contaminated objects, pus and putrid serosities, earth and manure.

The researches of Chauveau and Arloing have established that the *septic vibrio* of Pasteur is the agent of the gangrenous septicæmia of the human and of the animal species. This anærobiotic vibrio presents itself under two principal aspects : 1st, under the form of *rods* (*batonnets*) or of threads, more or less long and mobile; 2d, under that of *germ-corpuscles*. A completely developed adult is killed by the oxygen of the air and by that which liquids hold in suspension ; but the spores are not at all affected by this agent. If the septic elements contained in liquids or solid matter forming a coat of a certain thickness, are exposed to the air, notwithstanding the action of oxygen, the vibrios concealed in the depth of this coat multiply and develop spores—the " vestals " of septic virulency—in spite of oxygen and most microbicide agents. It is these spores confined in septic matters which constitute the agents of contagion ; after desication and disaggregation of this matter, they form the *septic dust*, the seed which transmits everywhere the dangerous infection.

Fresh virulent serosity energetically resists antiseptics. The most powerful of those seems to be sulphurous acid. Permanganate of potassium, 1 in 20, only attenuates the virulency. Corrosive sublimate, 1 in 1000 or 1 in 500, is without action upon it. Carbolic acid, 3, 2, or even 1 in 100, destroys the *dry virus* after six hours' contact. Putrefaction kills it also. But matter dried between 15–38° C., before putrefaction takes hold of it, preserves its virulency for years (Chauveau & Arloing).

The already old experiments of Billroth, then those of Jeannel and Laulanié (1885) have shown that septic elements do not pass through granulating membranes. Wounds entirely covered with intact granulations are protected from septicæmia. They can be sprinkled, with impunity, with septic liquids, even covered afterwards with a dressing, and not be infected; and though they absorb a certain quantity of ptomaines, no serious symptoms of poisoning appear. But, should the granulating membrane be chafed and the barrier that it forms be removed from any place, no matter how small, the condition is realized for septicæmia. The vascular apparatus, when perfect in the constitution of the walls of its numerous canals, is not very favorable ground

to the development of the septicæmic process. One may inject with impunity into the veins of a susceptible animal filtrated septic serosity, free from its figurated elements and containing only ptomaines (Chauveau & Arloing). Although serosity, not filtrated, injected in rather large quantity, produces death with generalized lesions, which are particularly marked in the serous membranes, small doses of this serosity do no harm, providing the vascular walls have no solution of continuity to allow the irritation of the septic germs into the tissues; but if a subcutaneous trauma is started in an animal in which virulent serosity has been injected, a septic center appears at the injured spot. We may recall the celebrated experiment of the double-twisting (bistourage) made by Chauveau (1868), always repeated with the same results: the testicular traumatic center produced after the injection of the septic corpuscles into the general circulation became invariably the starting-point of a fatal septicæmic process.

The smallest solution of continuity may be the starting-point of septicæmia; it occurs, however, always by preference on extensive and deep wounds. Its appearance is singularly excited by the contused condition or the ischæmia on a large surface of the injured tissues by the presence of cul de sacs, or anfractuosities where oxygen has difficult access, or by the presence of blood clots, of small spots which will gangrene or are already mortified. Even in recent wounds septicæmia has little show when the injured surface is widely exposed to the action of air, especially when it is submitted to continued irritation with aerated water. In those conditions the septic vibrios which mark its surface are destroyed by the oxygen and the spores remained inactive (Pasteur).

Independently of *puerperal septicæmia*, which is a streptococci infection (Chauveau), there are traumatic septicæmias which are not due to the *bacillus scpticus gangrenæ*. These infections are produced by micro-organisms—some of which are known (streptococci, bacillus of Novy), while others remain to be studied. We wish only to mention them.

Gaseous gangrene, more or less rapid in its progress, is announced by phenomena which mark it well. The suddenness of its invasion; the severe phlegmasia which takes place round the wound and spreads rapidly in all directions; the œdematous circle which binds it; the progressive mortification and the putrefaction which follow it soon; the fœtid odor exhaled from the septic center; the hyperthermia and the other general symptoms, form a clinical picture which cannot be mistaken for any other, at least in horses, and in most of the other species. Excepting the tumor of symptomatic anthrax, which cattle have, all the other inflammatory, *crepitating* tumefactions observed in animals and produced by different microbes have in common, together with septic swelling, only crepitation.

The *prophylaxis* is based upon the data of clinic and experimentation. We do not fear any longer this infection in the wounds of operation when those are made under the cover of asepsis, sewed up afterwards, and covered with a closing dressing. It is not much to be feared in wounds of operation which are *exposed* (castration), when the operation has been cleanly done by avoiding the soiling of the trauma with the hands, the instruments or other objects used. What is especially dangerous, as we have said, is not the air, as it was believed by the promoters of antisepsis, but "the dirt" that the surgeon, careless or unclean, carries into the tissue during the operation. The virulency of the septic matter deposited upon instruments resists the action of disinfecting solution, so that to destroy it with certainty they must be sterilized by heat. (See *Antisepsy*.)

The wounded should be placed in well-ventilated and clean-kept places. Gangrenous septicæmia occurs almost always in recent accidental wounds, not yet protected by the granular coat, or in contused traumatic lesions, anfractuous, and soiled with dust, earth, mud, and manure; and those are the ones which require good watching; they are those which demand especially the most minute disinfection and the free antiseptic irrigations. Drainage and iodoform plugging are very useful for deep traumas which, in certain regions (chest, axilla, groin, perineum), extend deep into the cellular layers infected with blood and serosity where the germs of the frightful gangrene collect and multiply with a fearful rapidity. The researches of Forgue have taught us that iodoform is the surest agent for destroying them. One should prevent the gatherings into the center of the wound—into its shallows and its out-of-the-way corners—of clots of blood and of secreted liquids; washings with solutions of carbolic acid, permanganate of potassium, iodine, and chloride of zinc should be made. Concentrated alcohol and the tinctures have been advised to create, on the surface of the wound, by the coagulation of the albuminous liquids, an isloating coat impervious to septic liquids. The strong solution of carbolic acid acts in the same way. Continued irrigation or washes frequently made take away the products of the secretion of wounds, interfere, by the action of oxygen, with the evolution of the vibrios, and prevent their entrance into the tissues. Sometimes injection appears in wounds already old and protected for a long time by a layer of granulations when they have been opened by an incision or by tearing; therefore, injuries to these granular covers must be avoided as much as possible.

When septicæmia has appeared, so that already the wound is surrounded by a tense swelling, crepitating, and œdematous on its borders —what means are to be used? In veterinary as in surgery for mankind the disease is said to be incurable and all therapeutics useless. But as serious as gaseous gangrene may be, when it has not yet ex-

tended over a large surface, where it is limited to a region regular in its external conformation and formed of muscular layers, when its evolution is not "fulminating," and when the organism is not seriously intoxicated, art is not disarmed; a powerful intervention may yet be followed by success. It must be acknowledged, however, that the number of recoveries has been exaggerated, by reporting, under the name of "septic gangrene," œdematous or crepitating tumefactions which had nothing septicæmic in their nature.

Every subject affected with septicæmia must be placed in a place where the air can be frequently changed and where the floor and walls can be sprinkled with disinfecting volatile liquids: the antiseptic vapors will spread in the air, penetrate into the organisms by the lungs, and may act favorably against incipient intoxication.

Excision of the aseptic tissues with the knife is a process that we do not recommend. It is always difficult, and often impossible to mark the correct line of demarcation; the wound thus produced has often a great extension and depth; and no matter how large the ablation may be, there almost always remains an infected zone, the ground occupied by the bacilli extending beyond the marks made by the surgeon. Interference should consist in deep, numerous scarifications made on all the contaminated surface and a little beyond its outlines. The cautery is to be preferred to the bistoury to make them. These scarifications allow the escape of putrid liquids and gases accumulated in the sphacelated parts, and of the serosity gathered in the œdematous region. Afterwards should follow, several hours apart, antiseptic injections of a strong solution of carbolic acid, corrosive sublimate, or permanganate of potassium, which, thus carried directly into the bottom of the infected tissues, may arrest the pullulation of the septic agents. A long trocar may be used to make them penetrate deeply. The entire surface of the gangrenous center must also be irrigated with the disinfecting liquid.

Trasbot finds the best local treatment of septicæmia in cauterization in points quite large and deeply penetrating into the septic swelling, with injections of tincture of iodine two or three times a day into the points, and iodine coatings painted with a brush over the invaded region. Many times has it been "very efficacious" in one of the most dangerous forms of traumatic gangrene.

The introduction into the circulation of the toxic substances elaborated on the gangrenous surface produces an increasing depression in the patient. If it is yet willing to take liquids let them be added to these diffusible stimulants (wine, alcohol) or antiseptics (cresyl, carbolic acid, camphor, tannin, cinchona). If not, those medicaments should be administered through the rectum. Cresyl, naphtaline, and subnitrate of bismuth are useful in septic diarrhœa. Subcutaneous injections of ether or of caffeine should be prescribed if the heart is weak.

In cases where the diseased process is recent, there is some hope of recovery; but as soon as an extensive territory is invaded by the bacilli, the infection is generalized, and the organism deeply intoxicated, there is no agent that can arrest the progress of septicæmia. Local disinfection, tonics, and diffusible stimulants administered internally, only extend by a few hours a useless fight. By the extreme weakness of the subject, the depression of the pulse, the coolness of the body, it is easy to see that death is approaching.

The researches of Chamberland and Roux have shown that it is possible to give animals immunity from gangrenous septicæmia, by injecting into them a sufficient dose "of a completed culture of septic vibrios, freed from all the microbes which have proliferated; that is, by having been heated to 110° for 10 minutes." This is a peculiar fact of the method of vaccination with soluble substances. The continued action of heat and of antiseptics upon the virulent pus furnished by trituration of the muscles of an animal killed by traumatic gangrene, has also given to Cornevin vaccines capable of freeing animals from this disease. But the duration of the immunity lasts only from fifteen days to a month. On this account, these means of giving immunity have not been used outside of the laboratory; they are without practical application

PUTRID INFECTION—CHRONIC SEPTICÆMIA.

Under the names of *putrid infection*, *chronic septicæmia*, and *putrid intoxication*, have been described complications of traumas, and morbid conditions which are variable in their characteristics and their progress, and remain still doubtful as to their boundaries and nature. Putrid intoxication differs from septicæmia and purulent infection; it is not accompanied, like the first, by gangrenous phlegmasia of the peritraumatic zone; and at the autopsy of those that die with it, metastatic abscesses are not found disseminated through the organs, as in the second. Complication of large suppurating or gangrenous wounds, it seems due especially to the absorption of putrid liquids, and of soluble poisons accumulated on the wounds. Colin proved this experimentally. In some cases, at the same time that the ptomaines are absorbed, the organism may be invaded by microbes of various species and virulency: micrococci, staphylococci, and bacteria. Putrid intoxication has a march more or less rapid. According to the quantity, the degree of nocidity of the toxic products, and the pathogenous activity of the micro-organisms which have entered the blood vessels. It may kill in a few hours, even in twenty-four hours; but, ordinarily, it proceeds more slowly, and in its principal clinical characteristics differs little from pyohæmia.

The *prophylactic treatment* demands the same means as that of puru-

lent infection. Putrid intoxication has, moreover, become very rare, since the era of antisepsis. The extensive purulent centers, the burrows, and the underminings where pus decomposes and putrefies, should be frequently cleansed and irrigated with strong disinfecting solutions. If the matter secreted by the wound is retained on account of its disposition, enlargement of the wound and counter-openings should be made with the cautery, and perfect drainage secured.

As soon as the first indications of putrid intoxication are present more care must be given to the traumas, disinfecting irrigations must be repeated, nebulizations or baths increased, as the region permits. If this is large and extended, its superficial layer should be destroyed with the red-hot iron; in this way, an obstacle to the absorption of the putrid poison will be established. On wounds that suppurate freely, one should use absorbing and antiseptic powders: coal, coal-tar, cresyl, tannin, alone or mixed with iodoform. There should be administered internally, tonics and stimulants (sulphate of quinine, carbolic acid, salicylic acid, creolin, alcohol, hay teas). When animals have no diarrhœa, according to some veterinarians, it is well to cause one, in order to hasten the elimination of the absorbed toxic matters.

IX.

TETANUS.

This toxi-infectious disease, frequent in horses but rare in the other animals, is produced by an anacrobiotic bacillus—the *bacillus of Nicolaïer*—which penetrates into the organism through a solution of continuity and gives birth to poisons, whose action upon the nervous centers promote tetanic convulsions.

Up to our time, there were recognized: 1, a *traumatic tetanus*, having a wound for starting-point; 2, a *spontaneous tetanus*, able to appear in the absence of a trauma. This old conception of the duality of tetanus still has advocates in both medicines. Facts are adduced in its favor to the effect that the disease has made its appearance without being preceded by a visible lesion of the tegument which would permit the passage of the tetanigenous agents; but these facts are far from possessing the value attached to them. If, indeed, the specific bacillus has a marked predilection for deep, anfractuous traumas, with bruised borders, ischæmic or gangrenous, there are other ways of entrance which may remain easily overlooked; such as the superficial wounds of the skin, concealed by the hair, so common in regions in contact with the harness or on the extremities; such as the lesions of the velvety tissue, which occur in the median lacunæ of the frog when this is thrushy, or at the commissures of the plantar sole, when there is a loose portion of the wall; and such as the wounds of all kinds developed on the mucous

membranes. And when tetanus appears, the trauma, which has permitted the passage of the pathogenous agents, can be entirely cicatrized. For these reasons, the numerous observations of "spontaneous tetanus" collected in the past and those that are reported in our own day cannot be seriously opposed to the results of experimental researches, which have shown, as irrefutable, the demonstration that tetanus is always traumatic, always inoculated and always microbian. Without a wound and without the Nicolaïer bacillus there is no tetanus. There is no occasion to make exceptions for the cases of "tetanus consequent upon a contusion;" in these, either there has been, on the surface of the injured part, destruction of the epidermis and introduction in that place of the specific elements through a lesion to all appearance closed, but in reality open, or the disease has had for its starting-point another solution of continuity, cutaneous or mucous, which remained unseen, and the incriminated contusion is only an incidental accident, having no relation to the tetanic complication except that resulting from their coexistence.

Enzootics of tetanus have no other cause than the *microbe*, the *trauma*, and the *cold*, which promotes its infection. If the Nicolaïer bacillus is the efficient cause of tetanus, some etiological factors noted by old observers remain as adjuvant causes of infection. Powerless to produce the disease, they diminish the resistance of the organism, and although their mode of action may be obscure they do not the less render the soil favorable to the development of specific germs. The most efficacious of these occasional causes is *damp cold*. Numerous are the facts collected in veterinary medicine, which show the disastrous influence of a damp and cold atmosphere. Those related by military surgeons are still more convincing than ours; sometimes, there have been counted by hundreds cases of tetanus in wounded animals exposed to the cold of night. In the polyclinic at Vienna, Roll has seldom observed isolated cases of traumatic tetanus; he has seen it almost always in several animals at a time. We have made the same observation at the clinic of Alfort. Months may elapse without a single case being brought to the consultation, then a time arrives—almost always after a lowering of the temperature—when several are seen in a week, even a day, upon animals coming from different localities. One must acknowledge, however, that the pathogeny of the disease is not entirely elucidated, and that certain conditions of its etiology remain yet unknown.

The microbe of tetanus has been found in various media. It is especially *telluric:* has for principal abode the superficial layers of the ground, where it is found more or less abundant according to countries and localities of the same region. It is very common in the northwest part of the Paris suburbs; more than three-quarters of the animals which we have treated came from there. It is found in dust, hay, water, dung, contents of the intestines, and on the surface of animals' bodies.

Kitasato has succeeded in isolating it in pure cultures (1889). It is polymorphous; sometimes it has the form of a regular rod (baton-net) with blunt ends, or of a delicate rod, short and sporulated (batonnet en battant de cloche), or of a spore. Under its bacillar form it is very vulnerable, succumbs in a few minutes to the action of a heat of 75°, or to the action of most antiseptics; but the spores, which are constantly in tetanic matters, enjoy a great vital energy; they resist the action of antiseptics and require a temperature of 105° and 115° to destroy them.

Vaillard and Vincent have observed that pure cultures of tetanic bacilli or spores act only by the toxines that they contain. Not only the microbe does not propagate in the tissues where it is deposited, but it disappears rapidly, and if, before it is inoculated, it is deprived of the toxine to which it is associated, the disease does not develop. It cannot produce its worst effects except when acting with some chemical substances or some ordinary microbes, especially the pyogenous. Inoculated alone, it is rapidly surrounded and destroyed by phagocytes; in company with other micro-organisms, as it occurs with wounds in ordinary circumstances, these attract the phagocytes, absorb their activity and leave to the tetagenous elements all freedom to act. From the wound where it is elaborated, the tetanic toxine spreads and arrives in the blood vessels; it fixes itself in the elements of the centers. The nervous cells contain in their protoplasm groups of elements possessing a special affinity for tetanic toxine, which they attract with great force; once the toxine is fixed on these elements, it remains on them for a long time and the lesions of the cells disappear but slowly. They take place as long as the wound remains infected, as long as the microbian pullulation lasts; ultimately, it penetrates either in small quantity (chronic tetanus) or in doses rapidly fatal (acute-tetanus). Thus are explained the persistency and increasing severity of the symptoms.

The tetanic toxine gives rise to very different effects, according to the doses in which it is injected. On this, we have (1) doses that kill; (2) weaker doses, which give rise to more or less serious disturbances, but are not fatal; (3) still weaker doses, allowing immunization of animals without producing visible troubles.

In 1891 Behring and Kitasato found that the liquids of animals made refractory to tetanus by the injection of toxine had obtained antitoxic properties. Those liquids (humours) contain an antitoxine which may inhibit, render harmless, an enormous proportion of tetanic poisons. The injection of a small quantity of serum renders animals refractory to tetanus insensible to the action of a large dose of toxine. It allows preventive and therapeutical interference. Kitasato having found that antitoxine subsists for some time in the organism of the horse, recommended already serum to treat the disease in that animal.

Antitoxine is possessed of affinity for toxine and draws it away from the nervous centers which it particularly prefers; but it is without action upon the toxine already fixed by the nervous cells. Recently Wasserman has shown that tetanic poison loses also its toxic properties when it is mixed with the crushed cerebral substance of a healthy animal.

All traumatic lesions can be followed by tetanus, whatever their extent, depth, or serious nature may be. Observation has shown their frequency after wounds of the lower regions of the extremities, of the genital organs or of the head. Bruised, irregular wounds, gun-shot wounds, those by tearings, crushings, those containing foreign bodies, fistulæ, pricks, burns, congestions, are peculiarly exposed to it.

In horses, the traumatic lesions which are most commonly followed by tetanus are: Punctured wound of the foot by nails, corns, quittors, interferings and wounds made by harness. In most cases it follows deep, irregular wounds, involving tendons, bones, articulations and nerves, or those containing a foreign body—splinter of wood, projectile, metallic fragment, piece of leather or cloth, vegetal parcel or small gangrenous stricture.

Wounds of operation, like accidental traumas, may be complicated with tetanus (*tetanus* of *operation*). It has been observed very often after castration of males, the introduction of serum, various foot operations, less commonly after ovariotomy, the operation for inguinal or for umbilical hernia, caudal myotomy, amputations of the tail, removal of tumor, firing, the application of a blister, puncture of the cæcum.

Insignificant superficial traumatisms are sufficient for its apposition; sometimes it follows venesection, a simple cutaneous puncture, even from an hypodermic injection.

In females, more commonly in cows, it is observed after parturition or abortion (*puerperal tetanus*). Most of the cases related in bovines have been observed in cows after difficult labor, wounds of the vagina, uterus, or imperfect delivery.

In young-borns, principally colts and lambs, tetanus may be a complication of umbilical phlebitis, especially when it is purulent, gangrenous or septic (tetanus of new-borns). In lambs it is not rare to see the disease become enzootic.

Tetanus generally makes its appearance from the third to the fifteenth day of the wound, sometimes the second, or even the first; at others more lately, during the third or fourth week, in some cases only when the wound is already cicatrized. The difficulty in moving, stiffness of the extremities, extension of the head on the neck, are the first troubles noticed. Sometimes the contractions are generalized from the start, in others they began on the head and neck, on the hindquarters, or the muscles in the neighborhood of the wound and gradually extend to

the trunk or the extremities. The nostrils are dilated, lips contracted, ears erected and stiff, eyes partly covered by the nictitans, tail more or less elevated and stiff. Contraction of the masseters—trismus—is more or less marked, prehension of food and mastication are difficult or impossible; saliva slobbers from the mouth. In most patients the muscles of the tongue, pharynx, and larynx are also contracted.

Ordinarily the neck is elevated and the dorso-lumbar regions slightly curved downwards (*opisthotonos*); in other cases the vertebral column forms a straight horizontal line (*orthotonos*); exceptionally it is curved one side or the other (*pleurosthonos*). Contractions are continuous, with spasms at certain times. Various causes of excitement produce increased convulsions. Respiration is difficult, more or less rapid; during the access it increases three or four times the normal number. At the outset, circulation is not disturbed, nor in the periods of calm, but it increases at the time of the access. Temperature remains normal or only a few tenths higher in benignant cases; in general serious cases are characterized by a rise of two or three degrees; however, they may also develop without great elevation of temperature. In the few hours preceding death it may rise to 42° C. and above. However, numerous causes exist to produce this hyperthermia.

In acute tetanus the invasion is rapid, the contractions are severe and generalized, trismus great, prehension of food and deglutition impossible, respiration very difficult and accelerated, pulse quick, paroxysms frequent, temperature elevated.

Death occurs generally from the second to the fourth day.

In chronic tetanus, incubation is generally longer, contractions slight, trismus weak, disphagia little marked, respiration and circulation not much disturbed, paroxysms rare, temperature normal or raised only a few tenths. There are cases where this condition remains stationary for two or three weeks; thus by degrees the contractions subside and disappear; in others the disease presents alternate conditions of improvement and of relapse until resolution takes place; finally, sometimes after a variable length of time, most ordinarily towards the end of the first week, the severity of the contraction increases, tetanus becomes acute, and death takes place within a few days. Even when the stiffness seems mild, the disease may last for weeks, and an increase, a relapse or complications ought to be always looked for. Pneumonia by foreign bodies is possible during the entire disease; it may occur during convalescence, the fourth week, or even the second month.

The principal symptoms of tetanus are the same in all species. In cattle the movements are less rapid than in horses and the contractions are less severe. On the contrary, in sheep and dogs the evolution of the disease is rapid. Death ordinarily takes place from the sixth to the eighth day.

Some authors believe that the mortality is not as high in our day as in the past, that acute cases are less common, which would be due to an attenuation of the pathogenous agent, or a more rational therapeuty. But in horses it seems to have preserved all its severity; only that which is observed is the predominance of acute or chronic cases, according to years or periods of times.

The *diagnosis* of tetanus offers no difficulties. In some light cases, one might, at first sight, mistake it for laminitis; but the generalized stiffness, the tension of the muscles, the attitude of the conical rod and of the head, the protruding of the membrana nictitans upon the eye, and the tail stiff and extended, are signs permitting the differentiation.

In all species of animals, the *prognosis* is most serious. In horses, the average mortality is 75%. Out of 30 horses affected with tetanus in our wards, from 1888 to 1894, 21 died—a mortality of 70%. Seventeen of those affected with acute tetanus died: 1 the day of its admission, 4 the second, 4 the third, 3 the fourth, 2 the fifth, 1 the sixth, 2 the eighth. Four others, in which the symptoms were less marked, died: 1 the tenth day, 1 the thirteenth, 1 the twentieth, 1 the twenty-sixth. Sudden attack, rapid extension of the contractions to all the muscular groups, complete trismus, sweating, great acceleration of respiration and circulation, and hyperthermia, are manifestations to be dreaded. The greater the dyspnœa, the more death is to be feared. A recumbent position is a bad sign. Almost all creatures affected with tetanus that drop down in a fit or through exhaustion, die quickly. At all periods of the disease, but especially in the first, death may be the consequence of pneumonia by foreign bodies. After the second septenary, the chances for recovery are great.

The prophylaxy of tetanus includes: 1st, the means belonging to surgery and hygiene; 2d, the injection of antitoxic serum. With the first, a treble indication is fulfilled: prevent the infection of the wounds of operations, disinfect accidental traumas, protect the operated and the wounded from the effect of cold.

Animals operated upon should be protected from tetanus by observing the rules of asepsis and antisepsis. The lips of aseptic wounds should be held together by sutures, covered with a dressing, or occluded with an impermeable substance (collodion); the latter dressing should be made at long intervals, as this renewal exposes the wounds to infection. Wounds of operation soiled during the interference should be minutely disinfected; if they are left open and exposed, they should be frequently dressed with antiseptic solutions. All suspected wounds, accidental or of operation, soiled by matter ordinarily tetaniferous (manure, ground), should be cleansed with a warm antiseptic liquid (a strong solution of carbolic acid), carefully washing every part and corner of them; all foreign bodies that they may contain should

be removed, without disturbing the parts any more than necessary, without enlarging the wound, and without exeresies. The bistoury, curette, or cautery should be used only in cases where portions of tissues are seriously bruised, crushed, and destined to gangrene, or are already necrosed. The purification of the traumatic center should be completed by a fresh irrigation, by balneation, or by atomization, according to the case. Afterwards it should be covered by a protective or isolating coat (carbolated or iodoformed vaseline). Finally the patients shall be removed from etiological influences which promote the action of tetanigenous elements: cold, rain, dampness. Under ordinary circumstances, veterinarians cannot realize in their practice the conditions of asepsis necessary to prevent tetanus entirely, but it is always possible to avoid those tetanic enzootia, which are so commonly reported; for this, it is sufficient to take stringent measures for disinfection, and see that there is perfect asepsis of the hands, instruments, and objects which come in contact with the wound.

Injections of antitetanic serum give a temporary immunity lasting at least fifteen days, but ordinarily remains from three to five weeks. First advocated for man by Vaillard, recommended by Nocard, they are absolutely efficacious, providing they are repeated at intervals of ten days, as long as tetaniferous or suspect centers are existing. Out of more than 2,000 wounded or operated which have been immunized by this serum, only one took lockjaw. In the practices where these facts have been observed and during the time the serum was used, nearly 200 cases of tetanus were observed in horses that were not injected (Nocard). To wounded or operated large animals, as early as possible an injection of 10 Cc. is made under the skin and renewed after ten days. When the trauma is extensive, complicated, suppurating for a long time, it may be necessary to make two or three other injections at intervals of twelve or fifteen days. With small animals, two doses of 5 Cc. are made. As long as the blood contains a sufficient quantity of antitoxine, the animals are protected. The serum is delivered in vials of 10–20 Cc.; it keeps its properties for several months. Let us remark that preventive serotherapy is practically applicable only to animals affected of wounds of operation or by accident, which have a certain gravity. But tetanus occurs quite frequently after slight wounds of the extremities, or after lesions which are overlooked.

Among the numerous curative treatments recommended, including the most recent, none has shown a great superiority over the others or succeeded in establishing itself. There have been recommended as surgical means, bleeding, cauterization, free excision of peritraumatic tissues, amputation, neurotomy, neurotripsy, polyneurotomy, stretching of nerves, even castration for horses; and cases of recovery have

been mentioned to prove the efficacy of all these treatments. But the facts reported were only those of benign cases of the slow form of infection of *chronic tetanus*, which, as Teissier says, *recovers with everything and often without anything.* Knowing the nature of the disease and the disposition of the tetanigenous agents on the wound, the only means which deserve any confidence are *cauterization*, *excision* and *amputation.*

The favorable results obtained by amputation in the case of mankind (Larrey, Berger), and the affirmation of bacteriologists that the Nicolaïer bacillus remain confined to the vicinity of the wound of inoculation, have induced us to try, without very encouraging results, the free incision and cauterization of the infected region, with a certain number of animals suffering from traumatic tetanus, which have been under our treatment during the last few years. In a general way, the free removal of the tissues of the peritraumatic zone—*eradication*—has shown itself much less advantageous than the simple disinfection and careful cleansing of the virulent wound. For man, Verneuil objected to the eradication of the toxic center, when it necessitates mutilation ; and Chauvel opposed to this treatment the experimental results of Vaillard, proving that the extirpation of a muscle in which a few drops of tetanic poison have been injected does not prevent the development of the disease. The rapidity of diffusion of the toxic agent goes counter, generally speaking, to free ablations.

As to the medical treatment, it counts agents without number, some harmless, others somewhat injurious, all of an indifferent value. Those that have been principally used are opium and morphine, belladonna and atropine, hyoscyamus, stramonium, alcohol, ether, chloroform, chloral, curare, Calaborbean, eserine, jaborandi, and pilocarpine, spirits of turpentine, with oil, iodine, salicylic acid, and quinine in intratrachial injections, bromide and iodide of potassium, and inhalations of oxygen, bichloride of mercury and phenic acid in intravenous injections, bromhydrate of quinine and antipyrine in intratrachial injections, and finally the antitetanic serum in cutaneous or intravenous injections. All those agents have given more failures than successes. None can overcome the tetanic spasm. Medicamental substances, however, which reduce the hyperexcitability of the spinal cord have a beneficial action and attest towards recovery : two especially, chloral and morphine, are advantageous and constitute the medicaments to be preferred. Morphine has the disadvantage of provoking phenomena of excitement in the horse ; it should be used only in small repeated doses ; in large or even medium doses, it has always shown itself to us more injurious than beneficial.* Chloral can be administered through the rectum by intravenous injections. If it is introduced into the digestive canal it

* *C. D. Norris* claims to have had good results by subcutaneous injections of sulphate of eserinic and dilute hydrocyanic acid. (Am. Vet. Rev. Vol. 15, p. 386.) (T.)

must be well diluted. We prefer giving it in lavements, 100 to 150 grammes a day and in solution of 1 in 50. The intravenous injections (Poitevin, Poret, Jacobin) must be considered as a last resource; 20 or 25 grammes of chloral are injected in the jugular, according to patients; often a temporary relief is obtained; the injection is repeated when the contractions return.

Let us present a curative treatment, according to the data already established.

Whatever may be the form of tetanus, one must, first of all, look for the wound, which has served as means of entrance to the bacilli. Cleanse it well with hot water, evacuate the recesses of the wound, disinfect it with care with strong antiseptic solutions (sublimate in acid solution, phenol, tincture of iodine or chloride of zinc), remove all foreign bodies, if there are any; in some cases enlarge the wound, excise the grangrenous or necrotic parts as as well the fungous granulations. After another antiseptic irrigation, the wound should be dusted with iodoform and covered with vaseline or wadding. If there are several wounds all should be treated with the same care. Some fistulous or anfractuous wounds require the ablation of a wide and thick layer of tissues to remove the toxi-infectuous center.

The antitetanic serum has not given the results that were first expected. Excellent to grant immunity, it is ordinarily powerless as soon as the poison has reached the nervous system. However, it may avert the increase of the manifestations by presenting new quantities of toxine reaching those centers.

The wounded should be put in a place where the temperature will be moderate and regular, and protected from exciting causes, noise, or strong light; if possible, this place should be isolated, spacious, dark, with an abundant bedding of supple and short straw, to permit the motions of the animal without his legs being entangled, as they might be were the straw long. Cut straw may irritate by pricking the skin of the extremities. A box stall is always to be preferred, with the window covered with a thick blanket, to make it as dark as possible. To be alone is sometimes a cause of uneasiness to horses; they get impatient and restless. Instead of placing them alone, it is better to have them standing in their own stalls, giving them quiet neighbors. Contagion might not be impossible for these, if they had wounds on them on which tetanic pus should be accidentally deposited; but direct contagion is an exception, and can be prevented by simple means.

The opening and closing of doors, surrounding noises, strong light, or touching with the hand, may promote exacerbations; frequent visits should be avoided; changes, examinations, and explorations are useless; no one except those who care for the patient should approach it. Rest, quiet, darkness, soothe muscular hyperexcitability; the attacks occur

further apart, the contractions diminish, the respiration is easier. During summer one should see that the animal does not suffer from excessive heat; in winter, he should be sufficiently covered to keep the skin slightly moist; if perspiration is too abundant, blankets must be changed. In severe cases, where there is danger of falling, slings are advantageous.

The patient should be sustained with substantial food. It should receive liquid food especially (mashes, farinaceous drinks, hay tea, milk, soup), grass and cool water at will. If trismus and dysphagy do not allow the swallowing of these substances, nutritive rectal injections should be given four or five times a day. It is sometimes necessary either to empty the rectum, or to help micturition, by pressing upon the bladder through the rectum, or by the introduction of the catheter. Besides this, injections of serum shall always be indicated to destroy the toxine which still penetrates in the blood. As medications, one should employ agents which can be used with food, drinks, or lavements, or in hypodermic injections (purgatives, alkalines, antiseptics, chlorhydric acid, iodine, morphine, chloral). The administration of drenches is sometimes impossible on account of the trismus; for us, these are always forbidden on account of the excitement they give rise to, the danger of their passing in wrong directions, and the severe complications following. One may, by giving daily 100 or 200 grammes of sulphate of soda in drinks, prevent constipation, and 2 to 6 grammes of aqueous extract of belladonna, or opium, will quiet the nervous irritation (Trasbot). In acute cases the hyperexcitability should be controlled with chloral, administered by injections through the rectum, and morphine in small doses by hypodermic injections.

CHAPTER IV.

GRANULATIONS—CICATRICES.

In the cicatrization of traumas with loss of substance, as soon as the granulations have reached the level of the skin, their growth generally ceases; they become even; their structure is more dense; connective structure develops in them; blood vessels are obliterated; cellular elements disappear by regression; the purulent secretion diminishes more and more; and at the periphery of the wound, at the limit of the cutaneous borders and of the newly formed tissue, there appears a slightly projecting circle, a kind of reddish band, which progresses slowly toward the center of the cicatrix, followed at a short distance by a very thin band of darker color. This new layer, which ordinarily spreads evenly on the innodular tissue from the periphery to the center of the solution of continuity, is the regenerated epidermis. Sometimes in large wounds, when small pieces of skin with the Malpighian layers have been preserved, the new formation of the epidermis takes place at several points. At the same time that the cicatrization advances, the tumefaction and the morbid sensibility gradually diminish and disappear.

But the repairing process does not always follow this normal progress. Often, especially with extensive lesions, the cicatrization is disturbed, the new tissue assumes a peculiar aspect or character, due to various pathological conditions of the granulations.

Sometimes, because of some disease or some general cause interfering, the granulation relaxes and stops before the wound is entirely filled. It must be stimulated by exciting preparations, strong antiseptic solutions or superficial cauterization with the nitrate of silver.

More commonly, the granulations rise quite high above the cutaneous layer, and are *exuberant.* Among horses and cattle, it is quite common to observe, especially on wounds of the extremities, cicatrices more or less protruding, which in their earlier stages can easily be controlled by the use of drying powders, styptic applications, pressure, or dressings with astringent preparations (tannin, white lotion).

Fungous granulations protruding much above the level of the skin, and sometimes covering its edges, assume an aspect resembling that of

mushrooms. Ordinarily soft, friable and bleeding, they secrete in various quantities a thin and serous pus. They are almost always due to local causes: sometimes the fungosities conceal or contain foreign bodies (granular wounds); at others the cutaneous edges are indurated, callous, or loosened for some distance; or again the edges are irritating to the granulations by their constant motion. In some circumstances, the cause of the anomaly cannot be made out. When the cause is established, it is simple to obtain the cicatrization by extending to it the treatment required by that cause; but it is necessary sometimes to excise the granulations or to destroy them, either with caustics (alum, nitrate of silver) or with the actual cautery.

Erethistic granulations are the seat of a well-marked morbid sensibility: the slightest touch upon it gives rise to sharp pain, combined sometimes with an alteration of the nervous fibers of the edges or of the bottom of the wound. Ordinarily, the peritraumatic zone is much inflamed. The anomaly may be due to the presence of foreign bodies; and their removal, the application of warm compresses or balneations, analgesical vaseline, iodoform or cauterizations slight and repeated are ordinarily successful. In some cases it is necessary to cauterize the entire granular layer, or the most painful parts of it.

One observes sometimes, in cicatrizing wounds of all animals, the infectious complication described under the name of *diphtheria of granulations*. It is a mild form of hospital gangrene. From one day to the next, the surface of the wound is covered with a diphtheritic yellowish gray layer several millimeters thick. Under this false membrane the granulations are softish, dark red in some places and yellowish or grayish in others. When this complication occurs on recent wounds not entirely protected by a granulating layer, it always is complicated with a serious lymphangitis of rapid development. Sometimes the granulations disintegrate and ulcerate, and a putrid detritus collects on the wound. We have observed this affection in horses and in dogs. Hoffmann has seen it in the horse; Möller in dogs and birds; others have mentioned seeing it in cattle. Cultures, on gelatine and gelose, of the products taken from the surface of the granulations have given us colonies of streptococci.

This diphtheritic condition of the granulations is treated by a minute disinfection of the wound with warm solutions of corrosive sublimate, carbolic acid or chloride of zinc. When it takes place upon an extremity, balneation in an antiseptic solution at 45--50° and iodoform dressing are very advantageous, especially if there is complication of lymphangitis. If the trouble resists, the surface of the granulations must be destroyed with the cautery or removed with the curette, and the wound must be dressed with iodoform.

The tissue of new formation which repairs solutions of continuity and losses of substance is at first, we have said, exclusively formed of embryonal elements and blood vessels; as its organization becomes more complete it sustains a retraction which gradually increases: the hair, follicles, sudoriferous and sebaceous glands are not reconstructed.

Fig. 46.—Horny Cheloid of the Left Foreleg.

Cicatrices whose development is complete are glabrous, dry, ordinarily indolent, smooth or slightly rough, marked with ridges and fissures little developed, sometimes with bands and grooves running in various directions. With some there remains, even for a long time, a great sensibility. When they are situated in regions where there are frequent motions (those upon which the harness is) or on the tissues of the foot, they interfere with work and even prevent it, or impose a more or less active interference, such as the removal of the innodular part, the thinning of the new hoof, or neurotomy. When the pain seems to be due to the adherence of the cicatrix to the tissues underneath, this must be divided subcutaneously and a sound adherence prevented by passive movements applied on the cicatricial plate. This operation is, however, seldom successful.

Projecting cicatrices, old and fibrous—the *cicatricial cheloids*—generally do not yield to the means for recent wounds which we have spoken of. Formed by dense connective fasciculi, elastic fibers, blood vessels and an epidermic covering, they are at times somewhat regular, at others mammillated, multilobular, always fibrous, whitish, glabrous, hard under the scalpel, or are covered with stratified epidermic layers or horny growths. Among cattle, we have seen some of those horny plates in various regions, and among horses, on the lower parts of the legs. According to their dimensions and the length of time they have existed, they are treated by cauterization or excision.

Recent sessile cheloids may disappear by long and continued methodic pressure or by repeated scarifications and mercurial applications. When these fail, ablation is the only treatment offering any chance of success. This is also the best way to get rid of enormous projecting cheloids, more or less pedunculated. Among animals, relapses are rare outside cases of cicatrices resulting from the extirpation of tumors. Primitive neoplasms of innodular plates are also exceptional.

Some very extensive wounds, and all those accompanied with loss of

substance, which occupy regions in the neighborhood of natural openings, may be followed by deformities and accidents more or less serious. The large cutaneous cicatrices of the lower segments of the extremities bring sometimes, by their retraction, permanent deviations of the bony levers; those situated near articulations interfere with movements; those of the coronary band deform the hoof, give rise to quarter-cracks and false quarters; others, developed in natural canals or in proximity with their openings, promote ectropion, contraction of the æsophagus, rectum, anus or urethra.

Among the deformities and the accidents due to cicatrices, there are some which can be prevented by more judicious selection of the therapeutic means applied to the original lesion, and by a close watching of the phenomena of cicatrization. The results obtained by Romary and Smith show that it is possible to prevent some deformities in animals by *cutaneous grafting*, which gives such happy results to man (Reverdin, Gosselin, Duplay, Ollier, Thiersch).

Their curative treatment demands methods which vary according to cases: section of cicatricial bands, forced dilatation of obstructed orifices and canals, special operations, and the administration of iodide of potassium—a medication preferred to overcome sclerous processes.

In certain regions where glabrous cicatrices are unsightly disfigurements on a horse, they can be removed by excising a long elliptical cutaneous flap, with the cicatrix in the center, and sewing, with silk or silkworm-gut suture, the edges of the new wound which have been made loose from the tissues underneath. To succeed in obtaining union by first intention in such an operation it is necessary to take all the necessary precautions for perfect asepsis.

This treatment can be advantageously applied to valuable horses having *broken knees* if their modes of standing are normal and their extremities solid.

Treatment by operation upon broken knees goes back to 1829. Cherry[1] made the attempt of removing a carpal cicatrix by excision of a vertical, elliptical cutaneous flap, with the cicatrix in its center. In order to assist the sliding of the skin, he also made on each edge of the wound, at some distance from it, longitudinal incisions parallel to the borders of the wound. This was an application, to the therapeutics of broken knees, of the old method of autoplasty, or *Celsu's method*, used for the treatment of various affections of mankind. Cherry was partly successful with a donkey, but was "disappointed" in operating on a horse. Other attempts made by

[1] *Cherry*, on Broken Knees: The Farrier and Naturalist, 1829, pages 38, 358, 372.

various parties were not much more fortunate. Before antisepsis was known they could not succeed. In 1889, W. Hunting and Duguid[1] made new trials. Like Cherry, they removed, with the cicatrix, a long elliptical cutaneous band, the long axis of which was parallel to the extremity; a pin twisted suture brought the edges of the wound together. They did not obtain a complete adhesive union; still, on one subject, there remained only a very slight cicatrix. Hunting advises operating only upon old cicatrices, and insists upon the necessity of immobilizing the leg if one would have complete success.

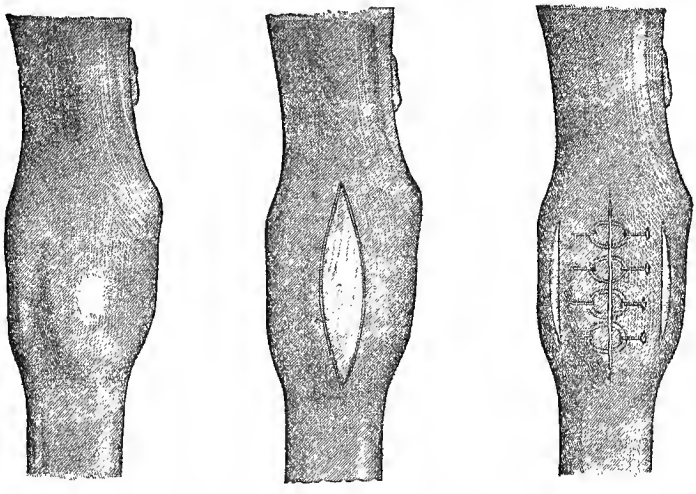


Fig. 47.—Autoplasty of the Broken Knee. (From Cherry, reproduced by W. Hunting.)

Delcambre and Vinsot[2] have reached this result by maintaining the most careful asepsis, and by immobilizing the leg in a plaster dressing. This is their method:

The animal is thrown on the side opposite the leg to be operated upon; this is carried in extension and strongly fixed. The anterior face of the knee is shaved, and this region and its surroundings, having been thoroughly disinfected, are wrapped in a cloth made aseptic by immersion in boiling water.

With scissors, an opening (fenestra), elongated in the direction of the leg, is made through this wrapper, on a level with the cicatrix. Two slightly curved incisions, meeting at a very acute angle at their extremities, define

[1] *W. Hunting*, the Veterinary Journal, 1889, p. 474.

[2] *Delcambre and Vinsot*, Bullet. de la Soc. Cent. de Med. Vet, 1894, p. 515.

the piece of skin to be detached, which is to be left as narrow as possible. It is dissected away from the hardened tissue underneath, the synovial membranes being carefully avoided. Hemorrhage is arrested by force-pressure, the wound is dried with aseptic plugs, and the edges are sutured with silkworm gut, the stitches being one centimeter apart. If the loss of substance is too great, before sewing, the edges of the wound are made loose underneath for an extent sufficient to permit their perfect adaptation.

The suture and the shaved surface are all powdered with iodoform and covered with iodoform gauze; absorbing wadding is wrapped round the knee, canon, and lower part of the forearm, and the whole secured by a large band of muslin. To insure immobilization, a plaster dressing is placed over the muslin, made of similar stuff.

On the tenth day the dressing is taken off. If the operation has been performed aseptically, union by first intention has taken place. Another similar dressing is applied, less the plaster, which has become unnecessary. This is removed after eight days. The cicatrix is then sufficiently solid to require no more protection or care. The animal can resume light work. A narrow line, subsequently covered by new hair, is the only mark left when the operation is well performed.

CHAPTER V.

SECTION I.

MYCOSIS.

I.

ACTINOMYCOSIS.

Comparatively common in cattle, observed also in horses, swine, sheep, dogs (Vachetta, Fröhner), and elephants (Burke), actinomycosis is a parasitic disease, produced by a fungus—the *actinomyces* of Harz. It exists extensively in Germany, the south of Russia, Italy, Denmark, England, and the United States, and has been observed in some parts of France. It is exceptional in the suburbs of Paris. In ten years, we have seen but one case among the cattle brought to the clinics of Alfort.

Actinomycosic tumors are primitive or secondary. The former exists on the parts where the germs have penetrated: on the skin, the mucous membranes, or the tissues that cover them. It has been observed in the skin and the subcutaneous connective tissue of a number of regions. Jensen has seen a pig which had, on the anterior face of the knees, two actinomycomas, weighing, one, two, the other four kilos and a half. In countries where the disease is enzootic, many traumas, the wounds of castration principally, become actinomycosic centers. Often their seat is on the head, where they invade the maxillaries. Such were those which, in 1826, Leblanc described as "*osteosarcoma*," and which others called "*spina ventosa*." Such are those spoken of in the observations reported by d'Arboval, Clarc, Dick, Daws, Dupont, Warnell, Delwart, Williams, and many others. While the tongue, the buccal and pharyngeal walls, the retro-pharyngeal glands and the parotid are often affected, the intestines seldom are. Rare also are the primitive lesions of the nasal cavities, larynx, lungs, of the udder or bones of the legs. In horses, cases of actinomycosis have been observed in bones, the tongue, subglossal glands and spermatic cord.

Primitive centers give rise to secondary lesions in their neighborhood or at a distance from them, and when the disease becomes generalized

they may heal, as in tuberculosis, without leaving apparent marks. Actinomycites ordinarily spread slowly, little by little, through the blood vessels, and apparently most often through the veins. All tissues and all organs may be attacked, and if, ordinarily, secondary tumors develop in the lungs, they are also observed in the liver, kidneys, spleen, serous membranes, lymphatic glands, and even the encephalon.

Fig. 48. Actinomycosis of the Lower Maxillary.

Locally, the disease progresses both by continuity and contiguity of tissues. For instance, pulmonary actinomycosis not only generalizes often in both lungs, but it extends from the visceral layer to the parietal layer of the pleura, obliterates the pleural cavity, and reaches the thoracic walls, where its clinical signs can be easily recognized.

Fig. 49. Actinomycosis of the Tongue.

The ways by which the actinomycites are introduced are numerous. Generally, they penetrate through tegumentary solutions of continuity, wounds of the skin, or mucous membranes, but especially by the wounds of the mouth and of the pharynx; at times they enter through natural passages, glandular canals and orifices of the teats; it is the exception for the disease to start in the intestines or the lungs. Pulmonary infection may take place from the dust blowing out of forage that contains actinomycites.

It is known that these germs have especially for habitat, plants, more particularly the gramineous, and among them barley and wheat. They are abundant in damp countries and during rainy seasons. As all fungi, they like darkness, heat, and dampness. They have been found in the glumes of wheat fixed in the tonsils, cheeks, and tongues of cattle (Johne, Piana). It is by eating contaminated seeds or forage that herbivorous animals are ordinarily inoculated. Thus it is also that the fungi may enter by way of a cutaneous wound, when animals are lying on beds which contain them, or rub themselves against soiled substances, trees or posts covered with them.

That they are caused by plants cannot be doubted, since the belief is based upon numerous facts. This explains well the frequency of the disease among herbivorous animals and its extreme rarity among other species.

All forms of actinomycosis, and especially those of buccal localizations, are observed less frequently at the time of the year when animals are kept in the pasture, than in winter when they are fed on dry food which wounds the buccal mucous membrane and makes a way for the entrance of the actinomycites (Eckert, Claus, Klepzoff). At the abattoir of Moscow, towards the end of 1893, the cases of buccal actinomycosis were twenty times more numerous than during the summer and fall of the preceding year (Klepzoff).

While offering noticeable differences, the statistics made by veterinarians of the countries where the disease prevails, show that actinomycosic lesions of the head, neck and skin are much the more common. Statistics of Claus give the following figures: Actinomycosis of the maxillaries (especially the lower ones), 51 per cent.; of the tongue, 29 per cent.; of the pharynx and peripharyngeal structures, 7 per cent.; of the larynx and trachea, 6 per cent.; of the thoracic and abdominal organs and other regions, 7 per cent. In those of Imminger, while actinomycosis of the tongue is mentioned only at 4–8 per cent., the localizations in other parts of the head and neck amount to 85–90 per cent. In 15 diseased cattle 14 had the maxillaries affected. In 541 observations gathered by Mary are found: 271 lesions of the skin; 177 of the sub-maxillary glands; 117 of the bones of the head; 51 of the retro-pharyngeal glands; 38 of the superior cervical glands; 29 of the lungs; 5 of the inferior cervical glands; 5 of the tongue; 4 of the pharynx; 4 of the bronchial glands; 4 of the diaphragm; 7 of the other organs (Friedberger and Fröhner). At the abattoir of Petersburg, where Ignatjew counts actinomycosis on about 10 per cent. of the cattle of Southern Russia, localizations on the lips and lower maxillary are the most frequent.

Most external actinomycoses exhibit the following aspects: Hard tumors, and an immediate inflammatory indurations and true neoplasms, hollowed

with numerous fistulæ from which escapes a pus more or less loaded with very small reddish-yellow masses resembling small gravel. Some forms of recent actinomycosis are neither ulcerated nor fistulous; they resemble sarcoma very closely and their center is hollowed by one or more purulent centers whose contents hold the actinomycetes in suspension. Others already large and protruding externally, are open deep down on a mucous membrane. In some cases secondary tumors are found irregularly distributed round the primitive tumor or arranged in chaplet form. Under the microscope the actinomycetic mass appears made of diverging, regular or undulous filaments, sometimes ramified and ending with pyramidal enlargements (conidia). This appearance in "umbrella" shape is sufficiently characteristic to permit the diagnosis.

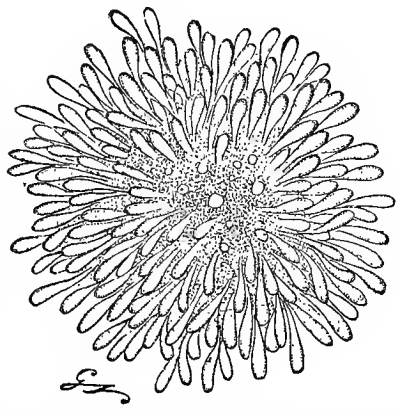


Fig. 50—Actinomycoses boris magnified 900.

The treatment of actinomycosic tumors includes the numerous means used against chronic inflammatory productions and against true neoplasms. Leblanc employed mercurial ointment and points cauterization; Cruzel, irritating frictions (spirits of turpentine and blistering liniments); Harms, applications of an ointment of equal parts of arsenious acid and lard. To dry the fistulæ, injections of sulphate of copper, carbolic acid, 10 per cent. (Rosenbach), and cauterization are recommended. These means have very generally failed. Extirpation of the tumor and the use of the curette have given better results in the case of external lesions. Where these "osteosarcomata" were treated early they gave way to surgical interference, but when the maxillary was invaded in a great part of its thickness, a secondary fracture was always to be feared. For this reason, in serious cases, it was better to have the animal destroyed. Some success has been attained in the case of man by the use of tuberculin (Billroth) and by electrochemical treatment (Darier, Gautier).

Numerous clinical facts obtained during the last few years prove that iodide of potassium is a true specific for the disease. Already in 1859 Dupont had reported several recoveries of "parotid indurations" by a complicated treatment into which iodide of potassium entered. But it was Thomassen (1885) who demonstrated the remarkable therapeutic value of this compound. Used first against "wooden tongue," which, was

cured in from two to four weeks, it was tried against osteosarcomata and some other localizations of the disease. The results were favorable in almost all cases, and healing often rapid (Furthmeyer, Bass, Nocard, Godbille, Salmon, Engel Iterson, Soucail). Thomassen administered daily one dose of 6 grams of the iodide in half a bottle of water; as soon as signs of iodism—epidermic pellicles, flowing of tears, coryza, diarrhœa—appeared, he lowered the dose to 4 or 5 grams.

At the onset of the disease, large doses of iodide (10 to 15 grams daily) must be given. Often, as remarks Nocard, the advantageous effects of the treatment are not manifest until the signs of iodism are present. Although local treatment is not indispensable, it is useful in the greater number of cases of external actinomycosis. For "wooden tongue," Furthmeyer advises painting the diseased organ with tincture of iodine; others inject the same liquid into the fistulæ of the osteosarcoma. In parotid actinomycosis, the ointment of iodide of potassium has proved advantageous.

In general, with the iodide and the local treatment, improvement is soon manifest; the swelling diminishes, fistulæ dry up, and after a few week, recovery is complete. There are some localizations, however, that remain obstinate (Salmon). With man, Poncet failed in a case of pulmonary actinomycosis. Several other surgeons have also reported failures.

II.

BOTRYOMYCOSIS.

Among the tumors of horses classed among fibromæ, there aresome that are of a parasitic nature, determined by a fungus that Rivolta has named *discomyces equi*, that Rabe called *micrococcus botriogenus*, and Johne *micrococcus ascoformans*. This parasite—the *botryomycis* or *botryomycete*—is the agent of a portion of the *funiculites*,which give rise to complications in the castration of solipeds; but its field of action is not limited to the spermatic cord: it has been seen in numerous indurations produced by the harness, in many of the tumors of the skin and of the connective tissue, in sub-maxillary adenitis and other lesions developed in many other organs. Bollinger, Steiner, and Thomassen have found it in sclerotic and purulent parts of the lungs; Sand and Möller, in indurations of the udder; Jensen, in a tumor of the fetlock; Kitt, in one of the tail and in a bony lesion; Rabe, in a tumor of the back. We have frequently seen it in various regions, in chronic inflammatory neoformations of the skin and subcutaneous tissues, sometimes also in old fistulæ, without strong indurations of the surrounding tissues. It is extremely rare in cattle (Csokor) and swine (Wilbrandt) and is not reported as found in other species.

In general, botryomycosic tumors grow gradually, and little by little invade the adjoining tissues. Like ordinary fibromæ, they leave intact the surrounding lymphatic vessels; by exception they extend to some distance by continuity and by contiguity of tissues; and thus they may each serous cavities and certain viscera, especially the lungs.

Fig. 51—Botryomycosis of the shoulder and chest (from a photograph).

In the horse, most of the fibrous growths hollowed by suppurating fistulæ are related to botryomycosis; the pus that escaped from them contains very small granulations, grayish in color and formed by the botryomycetes. To insure the diagnosis, one can color with picro-carmine a drop of the pus and examine it under a microscope of low power, when the parasitic masses, colored in yellow, will appear in varying number, ordinarily under the form of "blackberries," masses or clusters more or less voluminous, and formed of micrococci associated in zooglocia, sometimes in large disks lightly granular.

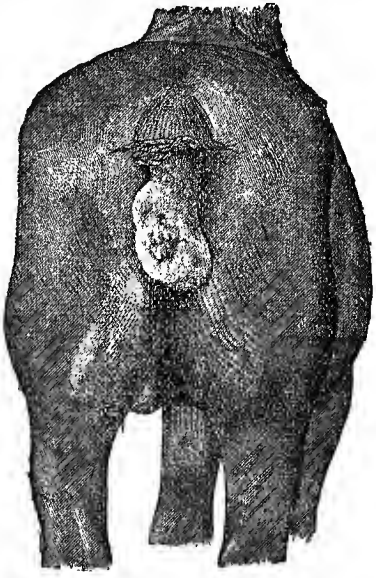


Fig. 52—Botryomycosis of the tail (from a photograph).

Until lately, the treatment of botryomycomas has been exclusively surgical. First they enlarged the fistulous tract, used antiseptic or escharotic injections and actual cauterization. As these processes generally failed, it was necessary to have recourse to ablation of the tumor. When it is of small dimensions, the operation

is easy, and is performed like that of *benignant* neoplasms; if the whole of the invaded tissues are removed, cicatrization takes place regularly. Some months ago we removed from the shoulder an old enormous mycofibroma, having many fistulæ which poured out a quantity of yellowish-white pus somewhat consistent and granular; the wound was closed in twenty days without any later interference being necessary. For the botryomycoma of the tail, the amputation must be made above the growth. The removal of the "champignon"

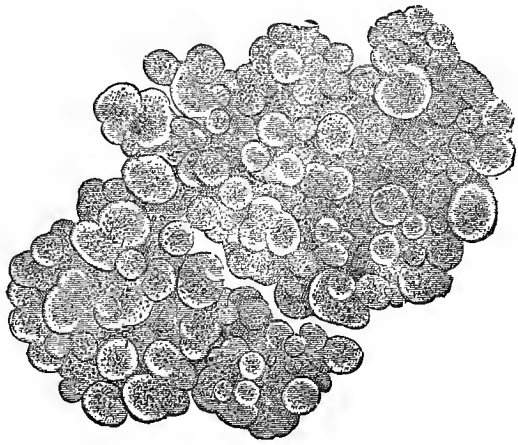


Fig. 53—Discomyces equi. (Gr. 160 P.)

is an operation of daily practice. (See *Testicle and Cord.*) But sometimes in cases of long standing the tumor cannot be operated upon, since the mycosic phlegmasia propagated along the testicular cord has reached, or gone beyond, the superior inguinal canal.

Thomassen, in several serious cases, has used with success iodide of potassium internally and tincture of iodine locally externally. The iodide was given in 10 or 15 gram doses a day, with two or three injections of the tincture into the fistulous tracts. This treatment may be useful, but it is slow in its action and not positive in its results. If it has given us partly successful cases, we have often used it for "champignon" and cutaneous mycofibromæ without the slightest benefit.[1]

We will resume the treatment of botryomycosis as follows: In all cases where the tumor justifies surgical interference, remove it at once; if the operation is impracticable or dangerous, try, for a few weeks, iodide of

[1] We have had several occasions to use this treatment on horses brought to the clinics of the American Veterinary College, and have generally obtained excellent results with it. (Translator.)

potassium internally and the injections of iodine externally. After this length of time, if no improvement is manifest, there is but little hope of the efficacy of the iodine treatment.

SECTION II.

VIRULENT DISEASES.

I.

BACTERIAN ANTHRAX.

Like septicæmia, *bacterian* or *symptomatic anthrax* is an infectious complication of wounds. Cattle and sheep are the only animals affected. It is of especially frequent occurrence among cattle, but animals less than six months or more than four years old rarely have it.

The specific bacterium—*bacterium Chauvæi*—invades the organism through wounds of the skin and mucous membranes, and has to be introduced deeply into the subcutaneous connective tissue. Intradermic inoculations and superficial pricks remain almost always sterile.

The disease develops ordinarily through the wounds that animals receive in infected pastures. Wounds of the lower regions of the extremities expose them to it particularly. The buccal and pharyngeal membranes are also roads of entrance favorable for infectious elements: there are frequent accidental wounds in them from the fodder, and the growth of the adult teeth keeps up for a long time in the mouth lesions by which the bacilli may enter.

After an incubative period of from one to five days—on the average forty-eight hours—the characteristic phenomena of the infection appear, namely, one or several subcutaneous, crepitating tumors and specific adenopathics in their neighborhood. These tumors are ordinarily located on the chest, axilla, shoulder, croup, thigh or groin. Although they are only more or less painful and of small size at first, they spread very rapidly and may in a few hours assume considerable dimensions; by palpation they give the sensation of crepitation; by percussion, a tympanitic sound; soon their center becomes insensible and the skin is cold and gangrenous. Puncture gives escape to a reddish fluid filled with gases. The prophylactic measures are to protect the animals from the infection by avoiding exposure or by rendering them unsusceptible through vaccination (Arloing, Cornevin and Thomas).

The malignant nature of the disease and the rapidity of its progress generally render all interference useless. "When recovery occurs, it seems to take place spontaneously; and when it is in connection with the

use of a more or less appropriate treatment, the part played by this treatment is very problematical and not well defined" (Galtier).

The local therapeutic means are the penetrating point, firing and the injection of tincture of iodine and carbolic acid or corrosive sublimate water in the tumor. Stimulants (alcohol, acetate of ammonia) and antiseptics (carbolic acid, cresyl) form the basis of the internal treatment. The proportion of recoveries does not go over 3 to 5 per cent.

The disease is the subject of special sanitary measures.

II.

BACTERIDIAN ANTHRAX.

Frequent in horses, cattle and sheep, *bacteridian anthrax* is rare in pigs and carnivorous animals. Its specific agent—bacteridia—may enter the organism through the digestive or respiratory mucous membranes and the skin. Infection by the digestive mucous membrane is the most common; it is produced by the spores of anthrax taken in with the food and drink. Inoculation ordinarily takes place in infected pastures (*champs maudits*), or when animals eat the feed grown on them, and it is most commonly carried through wounds of the buccal or pharyngeal mucous membranes (Pasteur, Toussaint). Infection through the lungs (anthrax by inhalation) is extremely rare. Infection by the skin, possible in all animals, is more common among horses and sheep than among the others. It gives rise to the forms known as *malignant pustule*, or *external anthrax*, he only ones which are interesting to our subject. Any solution of continuity of the skin or of the tegument of natural openings may be its starting point. It has sometimes been produced by operations with instruments which had served for post-mortem examination of anthrax cadavers; by the bite of dogs that had just eaten carbunculous meat, and by the stings of insects. Davaine, Bollinger and Zeilinger have given anthrax to animals by inoculating the matter obtained by the crushing of flies taken on anthrax cadavers. If left upon a wound, even the most superficial, the spores develop and are transformed into bacilli, which multiply, invade the surrounding tissues, promote in them a violent inflammation and a warm and painful tumor, whose dimensions increase rapidly, so that it soon presents a mortified center and an œdematous periphery. The bacteridies invade the lymphatics, the glands of which become inflamed and present constant lesions: hyperæmia, tumefaction, hemorrhages and œdematous infiltration (Colin). Being erobica, they can penetrate directly into the blood, where their multiplication is especially active.

Their *prophylaxis* imposes two principal conditions: Keep the animals

away from infected pastures; confer on them immunity from the disease by Pasteurian vaccination.

To destroy the anthrax virus deposited in the wound of inoculation, and to prevent its absorption by the circulatory and lymphatic channels, are the basis of an efficacious interference. Few advocate extirpation of the morbid focus. They prefer free cauterization with chemical substances (potash, chloride of zinc, corrosive sublimate) or with fire. The efficacy of *antiseptic* injections—solutions of corrosive sublimate (Kitsch, Kovalewsky), tincture of iodine (Davaine, Cézard, Raimbert, Joly, Baladoni, Chipault, Th. Anger, Verneuil, Richet), carbolic water (Chipault, Trélat, Proust, Mollière),—is established by many clinical observations. Since the bacterides grow well only in a temperature of about 37°, there has been an attempt to raise the heat of the surroundings of the diseased zone by the application of a warm iron, or to lower it with sprays of ether. The results have not been encouraging. The mixed treatment recommended for man by Verneuil includes: 1. The removal or complete destruction with the red-hot iron of the mortified zone. 2. The application of penetrating points of firing, one or two centimeters apart, all over the indurated part. 3. Injections of antiseptic solutions in the points of firing, and in the regions surrounding the swelling, so as to envelop it. The most highly recommended solutions are the tincture of iodine, pure or diluted, carbolic-acid water 1–2 per cent., corrosive sublimate 1 in 1000. These injections are to be repeated several times a day and sufficiently close to each other to permit the inflammatory centers they produce to gather together and form a bactericide protection. Between the injections, the lesion is covered with compresses moistened with a Van Swieten solution; antiseptic baths and a spray are also recommended.

Patients must be supported with strong food, stimulants (coffee, alcohol) and antiseptics (cresyl, 10 grams; tincture of iodine, a tablespoonful).

Special sanitary measures are also to be observed.

III.

FARCY.

Though a *morvo-farcinous infection*, and under all its forms susceptible of cure, it is not proper, with the therapeutical resources at our command at present, to undertake its treatment. Sanitary law orders the destroying of all animals affected with glanders or farcy. With very rare exceptions, the specific manifestations that we observe are secondary; they tell of a condition of generalization of the infection, often when it has existed for a long time, so that they condemn the animal immediately. In doubt-

ful cases, inoculation and malleinization assure the diagnosis. But an accidental cutaneous inoculation is possible, and then the evolution of the primitive lesion, or of the *farcinous bud*, may be observed.

The treatment of a primitive lesion, to be efficacious, must be applied early, before the diffusion of the contagion ; but generally, when the initial lesion is discovered, the first bacilli that have penetrated in the lymphatic channels are already beyond reach, and sometimes the infection is rapidly realized through the blood.

Free destruction of the farcinous bud or cord with the actual cautery, or with deep, close points of firing, subcutaneous injections and local applications of energetic bactericide solutions, are the rules for local treatment.

The best way to treat *pseudo-farcy* is by cauterization of the wounds, by antiseptic washes, baths, or dressings, avoiding the seat of the lesions; by perfect cleanliness of the affected regions, and by the internal use of iodine and arsenical preparations. (See *Epizoötic Lymphangitis*.

IV.

TUBERCULOSIS.

Frequent in cattle, quite common in dogs, tuberculosis is rare in horses, swine, sheep and goats. Among birds, it is most commonly met with in chickens, pheasants and parrots. The question as to whether the tuberculosis of animals and birds is the same in both, or different, is still discussed. Some bird species, the gallinaceous, for instance, are almost proof against tuberculosis of mammalia, but on others (psittaceous) inoculation succeeds easily.

Fig. 54. —Tuberculosis tumor of the periocular regions. (from a photograph).

The ordinary doors of entrance to the bacillus are the respiratory and digestive mucous membranes; and there are cases where it penetrates through the skin. In all animal and bird species, except in psittaci, external or surgical localizations are exceptional. Fröhner has shown that they are relatively common in the parrot. Out of 56 observations made at the Berlin school, Eberlein has found lesions of the skin in 29 cases,-of the bones and articulations in 14, of the eye

and periocular region, in 14, of the mouth and pharynx in 11, of the tongue in 9, of the larynx in 2, and often in this bird the cutaneous lesions seem primitive. Out of 35 parrots brought to our clinics during the last eight months, 11 were affected with external tuberculous lesions, mostly covered with a horny layer. These lesions, as well as the bony and articular manifestations, are much more rare in gallinæ.

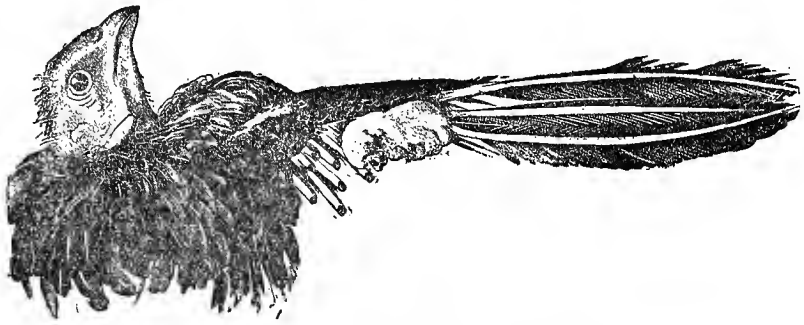


Fig. 55.—Tuberculous tumor of the wing. (Photograph).

In cattle one sees, sometimes, tuberculous places on the skin, the subcutaneous connective tissue or bones and joints. Morot has seen in a bull, scattered over the whole subcutaneous cellular tissue a large number of tuberculous tumors, varying in size from that of a pea to that of a

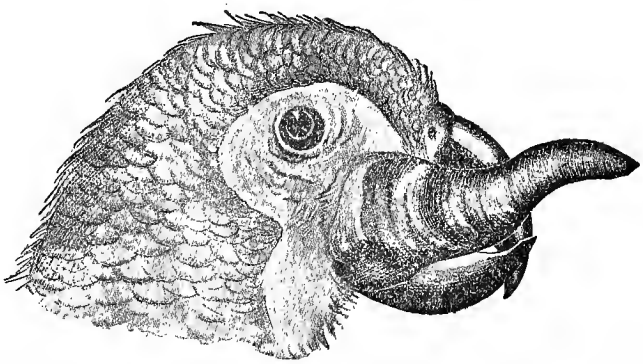


Fig. 56.—Horny growth on a tuberculous surface of the cheek (from a plate of Krampf).

nut. The testicle and lungs were healthy. Langdon Trothingham has observed in a cow numerous tumors of the skin which ulcerated and cicatrized; they were rich in baccilli and resembled the lupus of man. Muscular tuberculosis is extremely rare; few observations of this disease

on cattle and only one on a horse are on record (Cadiot, Gilbert and Roger).

External tuberculosis is also rare in dogs. Müller has reported one case analogous to one of ours. It was that of a seven-year-old slut belonging to a consumptive; she had shown first at the lower part of the neck a subcutaneous tumor as big as an egg, which later on softened and gave rise to a fistulous wound. External tuberculosis in cats has been recorded by Nocard and Jensen. (See *Tubercular Arthritis.*)

The diagnosis can be established with certainty by a bacterioscopic examination. Injections of tuberculine give also rare results.

Upon the statements of Louis, it was believed for a long time that surgical tuberculosis existed always with an infiltration of the lung, and that consequently surgical interference was useless. But recent observations have shown that the tuberculous virus remains sometimes for a certain length of time isolated in the place where it has been deposited, and that the extirpation of the primitive focus may be followed by recovery.

For tuberculous cattle sanitary laws prescribe special measures.

As a general rule tuberculous affections of other species are dangerous to man; veterinarians must advise their being destroyed. In the rare cases, where he must interfere for small animals or fancy birds, he will be guided by the rules for the treatment of tuberculosis in the case of man. Against the lesions of the skin and of the connective tissue, one must not stop at local applications, light cauterizations, or antiseptic applications, but must have recourse immediately to the eradication of the diseased center, which continually spreads the germs of contagion in the surroundings. The lumps of *lupus*, *ulcerated tumors* or *cutaneous growths* should be fully removed. The actual cautery should be employed instead of the bistoury, which opens the blood vessels and exposes the system to secondary inoculations. The wounds should be treated afterwards with iodoform. A local relapse implies a new exeresis. If the surrounding glands are involved, they must be removed.

Also bony lesions should be treated by excision and the use of the curette. Fungous arthritis should be treated by immobilization of the joint and injections of iodoformed vaseline into the fistulæ or those of chloride of zinc (1–10) into the zone neighboring the morbid center (scleragenous method of Lannelongue).

Hygienic and medical treatment must go along with the surgical interference. Good feeding, cod-liver oil, creosote and guiacol, also injections of creosote or gayacoli oil are excellent adjuncts of treatment.

[1] *Eberlin*, Monatschrift für Thierheilkunde, 1874, p. 261.

CHAPTER V.

TUMORS.

The etiology and pathogeny of tumors are still more obscure in the case of animals than in the case of man. The influence of *heredity*, admitted to-day almost without question by numerous and well-observed facts for carcinoma of man, seems also established for the other malignant tumors. Transmitted neoplastic diathesis may, however, give rise among offspring to neoplasms of the same nature as those developed in the parents, or of a different type. We have watched a slut operated upon twice a year apart, for cancer of the mammæ; her two daughters had a mammary tumor, one at four, the other at five years old. But few cases of this kind have been published, evidently because the previous and special clinical history of our patient is difficult to obtain and generally incomplete. *Species* has an undoubted influence. Although, indeed, all animals are subject to tumors, they are not subject to them with like frequency. Carnivorous animals and solipeds have them more commonly than ruminants; in certain species (dogs in particular) females are more exposed than males by the great proportion of 60 per cent. of the mammary tumors in females. *Age* plays an important part as predisposing cause. One hundred observations gathered by us of tumors in dogs are classified, according to age, as follows: Below three years, 6; from three to five years, 18; from six to nine, 33; from nine to twelve, 26; from twelve to fifteen, 14; from fifteen to twenty, 3. Therefore tumors are frequent in old animals, rarer in those of middle life; exceptional in young animals. But as each age has its diseases, it has also its tumors; in young subjects, benignant tumors are almost the only ones observed (polypi, papillomata); sarcoma is seen in adults and in all species, but carcinoma is certainly the neoplasm of the old.

It seems, also, that hygienic conditions to which animals are submitted, the *régime* especially, has an influence on the genesis of tumors. As Leblanc remarked, dogs that are fed on meat and deprived of exercise, kept tied up or indoors, are oftener affected with tumors than others. But it is useless to say that one can at will produce cancers in certain species by imposing upon them a special *régime* and mode of living; such an assertion rests upon no carefully established fact.

It has also been observed in animals that there exist close relations between cancer and *arthritism*. In some cancerous subjects whose antecedents have been known, it has been found that the history of more or less serious troubles was related to eczema or to arthritism. We treated a dog whose clinical history was minutely recorded. He died when four years old with generalized sarcoma, having shown at various times temporary lameness, in various locations, of a rheumatic nature, and this lameness appeared alternately with eczematous eruptions. Without the action of any violent cause, he became affected with sarcoma of the neck and of the femur, and died three months later. Trasbot has mentioned two observations in which arthritism and tumors succeeded each other at long intervals. With these rare facts, how many others there are in which cancer develops without being preceded by lameness or eczema, or any other arthritic disorder! The history of tuberculosis imposes the greatest reserve in the recognition of these etiological influences. It would not be at all surprising if some day experimentation would throw them back into the domain of imaginary causes.

Tumors appear, ordinarily, on organs or on external parts exposed to mechanical irritations; these, with *general traumatism*, have been considered the cause of their formation. But if, in a great number of cases, the influence of *secondary* causes of a mechanical nature can be accepted as a theory, it is far from being an established fact, and often this influence cannot even be brought into the question. Careful observation and experiments have shown, besides, that traumatic irritations are not sufficient to create neoplasms, especially malignant tumors. Almost all the neoformations which, in horses, appear on regions where the harness rests are chronic inflammatory lesions or botryomycosic products. The same is true of those which occur in other regions by the influence of frictions, pressures, slight and repeated contusions. In old sluts affected with chronic eczema, mechanical irritation applied on the mammæ and bruises, repeated every day, or every other day, for months, have failed to promote the formation of neoplasms: only an inflammatory swelling, sometimes an abscess, followed. Consequently, traumatism itself seems to act only as secondary cause.

"The recent discoveries made in the domain of infectious diseases have resuscitated the old doctrine of parasitism of tumors. A great similarity exists between the lesions of several parasitic diseases (actinomycosis, tuberculosis) and those of infectious malignant tumors; yet, up to the present time, there is nothing to show that the two processes are identical. Except the epitheliomatous graftings of rat upon rat, obtained by Moreau, and the successful grafts of polypi among dogs by Duplay and Cazin, all attempts to inoculate malignant neoplasms have either failed

or given only doubtful results. The numerous experiments that we have been making for the last four years for the purpose of transferring neoplasms from man to the dog, from horses to horses and dogs, from dogs to dogs, rabbits, guinea-pigs and hens, and from chicken to chicken,—all have failed completely: *we have not even succeeded when trying to graft upon cancerous dogs fragments of their own tumor.* Let us add, however, that we have transferred to three dogs, by rubbing the mucous membrane of the penis, papillomatous vegetations developed on the penis of another dog; but these productions remained local, decreased and disappeared of themselves. If these negative results do not allow one to deny the parasitic nature of cancer, they suggest changes in the experimental methods, since they tend to demonstrate that it is not by increasing the inoculations made in the ordinary way that the problem is to be solved. In man some observations have been mentioned which seem to establish the *contagiosity* of cancer; we have never observed anything like it in animals." [1]

In animals, as in man, tumors may appear on parts the most different, but they have a well-marked predilection for the skin, some mucous membranes and glands, the mammæ in particular. The testicle is, after the mammæ, the organ most often affected. The ectopia of this gland predisposes it to neoplastic degenerations: cancer of the testicle is quite common in monorchid and cryptorchid horses. Neoplasms are also quite common in the mouth, nasal cavities, sinuses, on the penis, the tail, the arms, on the inferior regions of the extremities, on the eye, in the thyroid or parotid glands, and on bones. Cancer of the tongue is extremely rare in animals; that of the lips is sometimes seen in old dogs; that of the uterus, so common in woman, is exceptional in female domestic animals.

All visceral cancers are much rarer than was formerly believed. In a great number of observations made upon tumors of the thoracic or abdominal organs, the lesions revealed in reality tuberculosis. This error has been current for a long time in the case of dogs, where tuberculosis is ordinarily manifested by large products developed in the viscera (liver, lungs, kidneys), lymphatic glands and serous membranes. It may yet persist, even with histological examination, which reveals a structure resembling sarcoma or lymphademia more than tuberculosis; it is only by the discovery of the bacilli and inoculation that the true nature of these products can be made out. Cancer of the liver and of the kidneys are the only ones which are frequently met with; that of the stomach is exceptional. In the inquiries which we have been making for several years, we have found, in the dog, several series of 10, 12, 15 cases of

[1] *Cadiot, Gilbert and Roger*: Les tumeurs malignes chez les animaux.—Presse Medicale, 1894, p. 219.

tuberculosis with lesions extending over a greater part of the viscera, without meeting a single case of true generalized neoplasm carcinoma or sarcoma). The same remarks apply to the horse; numerous cases of "sarcoma," and of "cancer," belong, in reality, to the group of bacillar lesions.

Most of the authors who have written upon the relative frequency of the various varieties of tumors declare sarcoma to be more common than carcinoma. The statistics of Semmer (1888), made from 57 malignant growths collected by him about various animals, counts 32 sarcomas against 25 carcinomas. Our researches, made more particularly among dogs and horses, have given results somewhat different from those of Semmer. "Out of 44 malignant tumors—38 from the dog, 5 from the horse, and 1 from the cat—we have found 32 epitheliomas and 12 sarcomas" (Cadiot, Gilbert and Roger). In dogs especially, epithelial tumors are the most frequent. Fröhner found out of 643 cases of tumors removed at his clinics, 262 carcinomas and only 44 sarcomas. We may add that, although in all species generalized sarcomatosis seems more common than carcinomatosis, it is evident that the difference is not so great as was believed up to the present time: that which has especially created and propagated this error is still the confusion established between tuberculosis and generalized sarcomatosis. We must, however, make exception for the melanosis of horses, which is very generally of a sarcomatous nature (Cornil and Trasbot).

Considered from a clinical point of view, tumors must be divided into *benign* and *malignant*, and into *solitary*, *multiple* and *infectious*.

By *benign tumors* is understood those that remain circumscribed and do not grow worse or return only by exception after they have been removed. *Malignant tumors* have a more rapid development, a marked tendency to spread, and give rise to secondary growths in their neighborhood or at some distance from them. Most commonly they grow worse.

A tumor is *solitary* when it is alone and benign. The neoplasms are called *multiple* that develop in a larger or smaller number in the same organ or the same systems of tissue. *Infectious tumors*, the most malignant of all, are soon accompanied by secondary neoplasms in their near neighborhood, in lymphatics, surrounding glands, or in the viscera: they become generalized through the lymphatic or venous channels, by a mechanism still undiscovered (infection or embolies). The neoplasms of this last group, which belong to various histological types, present great differences in their evolution and their tendency to generalization. Some, while spreading over the region where they first develop, remain in it some time confined, without any effect upon the surrounding glands; infection, when it occurs, taking place ordinarily by the venous

channels (sarcomas); others extend along the lymphatic vessels and stop at the first group of ganglia they reach (epithelial cancer); and others advance rapidly into the lymphatic vessels, and by a very active pullulation are soon spread over most of the viscera (encephaloid cancer). It is known that tumors that are rich in cells but little developed, and greatly resembling embryonic forms, are the most malignant and infectious.

With tumors of the same nature (carcinomas, sarcomas, or melanomas) the gravity and the tendency to generalization are almost always in direct proportion to the rapidity of development of the primitive tumor. Generally, in animals, carcinoma grows more slowly than sarcoma, although infecting little by little the lymphatics that sarcoma would respect. The skin is less often attacked by subcutaneous sarcoma than by carcinoma; its ulceration also is more rare and slower. Although while encephaloid carcinomas are seen developing very rapidly, and sarcomas remain localized for months, even for years, without disturbing the general health, it is nevertheless true that sarcomatosis develops more rapidly as a rule. The dog, of which we spoke above, affected with sarcoma of the penis, died from extensive lesions three months after the appearance of the original neoplasm; 2,200 tumors were counted on the surface of the lungs.

The *prognosis* of neoplasms, extremely variable, depends upon their nature, their seat, the rapidity of their growth, the integrity or invasion of the surrounding lymphatics, and the general state of the patient's health. Microscopical examination does not always allow the making of a prognosis in a positive manner. Exceptionally one will meet with fibromas of rapid growth and of a spreading tendency, and with others that recidivate. Epithelial tumors with nearly similar histological characters have been seen acting in different ways—some developing very slowly and remaining local, others spreading, recidivating and infectious. On the other hand, tumors truly malignant according to their histological characters have been observed whose cure was brought about by early and complete removal.

At any rate, a determination of the nature of a certain number of tumors by microscopical examination is somewhat difficult for one who has not made a special study of that portion of pathological anatomy.

In general, whatever may be the nature, age and seat of tumors, *ablation* or *destruction* by *caustics* is the only efficacious mode of treatment. For *benign growths*, the interference of the surgeon varies according to the clinical character of the neoplasm and the region it occupies. It is prudent to leave alone indolent, stationary or slowly progressing tumors located in regions where they give rise to no inconvenience. If they are, however, well pedunculated, they can be removed with the ecraseur or a non-extensible ligature. If they are small and do not spread at their base, the red-hot iron or potential caustics (potash, chloride of zinc, arsenious

or mineral acids) are sufficient to destroy them. When they are wide and flat or intimately implanted in the tissues so that their removal is to be made with the bistoury, one must carefully weigh the possibility of complications following the interference. Serious and even fatal accidents may occur from bloody exeresis of a benign and painless neoplasm which did not trouble the patient and might never have caused serious inconvenience. Should there be an oversight in the operation, septicæmia may occur from the wound made by the removal of an old neoplasm, whose slow growth as well as clinical manifestations positively indicated its benignity. Therefore, for these tumors, abstention ought to be the general rule. Let us remark, however, that tumors which may have remained benign for a long time, may at a given time rapidly enlarge and spread; as soon as this transformation takes place, they evidently return to the category of the malignant tumors and must be treated as such. Pedunculated tumors of mucous membranes easily explored (nose, rectum, vagina) should be removed with the ecraseur or torn off with the fingers.

During the last few years, the prophylaxis of cancer has been much talked about; but we have seen that, aside from heredity, there are no positive etiological data to admit it. It has been believed that cancer is more common in man since meat has entered in a greater proportion into general alimentation; hence the advice to eat less meat and a greater proportion of vegetables—a piece of advice which could be put in practice with dogs and cats if facts justified it. The relative frequency of cancerous growths among subjects affected with arthritis has suggested the use of arsenical or alkaline substances, either as therapeutic agents of the "neoplastic diathesis" or as prophylactic medication of carcinosis. Up to the present time nothing proves the real efficacy of these means.

At all times the cure of malignant tumors has been tried by the use of a great variety of applications and by a no less varied assortment of internal medications. Chlorate of potassium in powder or in saturated solution seems to be effective against some epithelial growths; some results have been obtained in cases of cancroids of the skin or the tegument of natural openings, but they fail with the epithelial growth of mucous membranes. If papillomas of the mouth in dogs and the growth of the lip of the cat, improperly called "cancroid," do ordinarily submit to the action of chlorate of potash, it is known that those growths are exceptions to the general law of the persistency of neoplasms; after a variable length of time almost always the ulceration of the cat's lip stops in its growth and heals; in the same manner the warts of the buccal mucous membrane of dogs shrink and disappear; it is rarely necessary to treat them actively. Against the ulcerated epithelial tumors of the lips, aniline colors can be

tried, in particular the solution of methylene blue; treatment recommended for man by Mosetig-Moorhof and Darier.[1]

Arsenical preparations (Fowler solution, arsenious acid) and iodine, recommended against sarcomas and lymphadenomas, have but little efficacy. We have often used them without the slightest advantage. Iodide of potassium has never produced a satisfactory change in the growth of neoplasms; it rather seems to stimulate their growth by the disturbances it gives rise to. As local applications, or to be taken internally, a number of compound mixtures, "antineoplastic" plants have been recommended, all without the slightest use. Electricity, which has given some successful results in the therapeutics of the uterine tumors of women, has not been much used in veterinary practice.

Some microbian inoculations have also been proposed for cancer. Among these it has been said that the streptococcus of erysipelas injected into sarcomas and carcinomas could arrest the process and bring on recovery, the tumors becoming affected with fatty degeneration and disappearing. We know also that this result has taken place spontaneously without those injections. Bacteriotherapeutics seems to have succeeded only in cases of such nature.

At the present time the only rational therapeutics of malignant tumors is *extirpation*. To obtain all that it can give, it must be radical and early. To make it radical, one must bear in mind that almost all these growths are surrounded by a zone infiltrated with neoplastic elements, though no alteration manifest to the naked eye can be observed in them. When secondary tumors are already developed round a diffused primitive neoplasm, the latent zone of infection may at times be very wide and then the ablation must be quite extensive. If the skin is more particularly the seat of this neoplastic infiltration this extends deeply into the connective lamellæ on the surface of the aponeurosis and into the thickness of all the tissues of that region. Independently of this zone of infection which surrounds the tumor, there is another formed by the blood vessels and the surrounding lymphatic glands; the latter is almost always rapidly overrun with the neoplasms of epithelial origin; often it is already infected when exploration fails to reveal any alteration; most often, however, the lymphatic vessels show small nodosities here and there along their length, and their collecting glands are hypertrophied and indurated. In such cases the removal of the growth must necessarily be completed by that of the infected lymphatic structure. Numerous are the mammary neoplasms of sluts that demand such extensive removals. The trouble must be followed up in the groin to its roots. Some of the diseased glands cannot be reached; operation is then powerless to bring about recovery. It is

[1] *Mosetig-Moorhoff, Darier:* Semaine Medicale, 1894, pp. 228 and 238.

the same for old tumors of the mouth, of the nasal cavities, for those of the testicle, the anus or the rectum. For a greater reason, when the tumor is already more or less generalized, when the patient is weak, in a cachectic condition, interference is forbidden, as not only would the operation be a failure, but it would accelerate the progress of the disease.

Interference is also to be forbidden when the neoplasm, located in some regions, has extended far into the subcutaneous layers. In sluts and female cats, ulcerated mammary tumors are found which have invaded the entire thickness of the abdominal wall, and whose removal could not be performed without removing a large portion of this wall.

Then, again, there are tumors which, though circumscribed and of small extent and depth, and not involving the lymphatics, do not justify extirpation: these *noli me tangere* recidivate immediately, develop more rapidly, and are endowed with a more marked infecting power than previous to the interference. The seat of the neoplasm sometimes imposes abstention from operation; animals affected with malignant tumors of the mouth, of the sinuses, the larynx, the œsophagus, or the rectum must not be operated on. The prognosis is sometimes aggravated by the age, and by some morbid conditions (albuminuria, cardiac affections, diabetes).

Once decided upon, the operation must be performed with all antiseptic care. If the tumor is ulcerated, it should be disinfected with a strong solution of chloride of zinc, the suppurating surface should be curetted as well as the fistulous tracts, if they exist. For ablation, the bistoury will be preferred; it is better than any other instrument, because it will permit a total and methodical excision. The large blood vessels should be obliterated with forceps and ligatures, and the hemorrhages of capillaries should be arrested with actual cauterization. In dangerous parts, a careful dissection will allow one to avoid the arteries, veins and important nerve branches yet unaltered. With some tumors, enucleation with the blunt probe or the finger is advantageous where connective layers exist. No neoplastic nucleus should be allowed to remain; all invaded lymphatic glands or vessels should be taken off.

Excise all that is morbid, all that seems diseased; remove the immediately surrounding layer, which is often affected with neoplastic elements to a depth, at times, a centimeter thick, and only stop when sound tissue is reached. Such is the rule, which must be strictly observed. In leaving a suspicious cutaneous fragment, or a piece of doubtful tissue, relapse is to be feared. After carefully cleaning the wound and completing the hemostasis with actual cautery, it should be dusted with iodoform, or a mixture of tannin and iodoform, its edges brought together

with separated sutures, and the whole covered with a coat of collodion or with a dressing.

In every case, if possible, and even if the solution of continuity has to be large, complete extirpation should be made at one sitting. There are cases when successive interferences are necessary to remove a neoplasm in its entirety, and then there remains, in some parts of the large wound, small spots of repullulation which demand another surgical operation with the bistoury or the actual cautery. Quite often in sluts, notwithstanding the total removal of mammary tumors, another interference is necessary after a variable length of time; and even then the patient cannot be saved.

Although we possess a certain number of observations on radical cures of neoplasms which histology had declared incurable, it is, nevertheless, true that the recidivity of malignant tumors is the general rule.

Let us now consider the special methods of treatment of the various kinds of tumors.

Fibromas, which are to be placed among the most benign growths, recidivate but very rarely after removal, and when they do they affect the structure of sarcomas. Some retrogressions are also explained by errors of diagnosis: carcinomas or sarcomas which had undergone fibrous transformation or growth were mistaken for simple fibromas. The ablation of fibromas is ordinarily done with the bistoury: if the wound remaining is small, first-intention cicatrization is possible. When the tumor is pedunculated, the ecraseur or elastic ligature can be used. The slow action of this latter, the putrefaction which takes place in the tumor before its complete section, and the fetid odor coming from it are objectionable; for these reasons it is advantageous to combine ligature with excision; twenty-four or thirty-six hours after the application of the ligature the tumor is cut off close to the ligature and the stump left to its spontaneous slough. Sometimes the actual or the thermo cautery are used also. Some sessile diffused fibromas may also be destroyed by actual or potential cauterization.

Circumscribed myxomas are treated by total removal with the bistoury or ecraseur; sometimes they are torn off with the fingers. *Diffused myxomas* demand a careful dissection of the roots which extend into muscular spaces. The former rarely recidivate, the latter more commonly. When they do, the new growth ordinarily offers the structure of a sarcoma. For small animals, if a myxoma of a leg returns, amputation is better than a second removal.

When *lipomas* are large and troublesome they are removed with the bistoury. The operation is very simple for circumscribed, but rather

difficult for diffused, lipomas. If the tumor is voluminous, an elliptical cutaneous flap is removed with it. Union by first intention or sutures with drainage, according to the extent of the wound, complete the removal.

Papillomas are generally not serious. They are destroyed with the bistoury or the ecraseur (ligature with silk threads) when well pedunculated, or repeated cauterization of nitric acid. Radical recovery of warts and cutaneous growths require ordinarily the removal of a portion of the skin where they are implanted. Papillomas of the mucous membranes (vulva, vagina, uterine neck) are treated with excision; sometimes they return and require being operated upon again after a variable length of time (weeks or months); but even in these cases radical recovery is not rare.

For *cysts* two methods can be employed: (1) Extirpation of the growth; (2) evacuation of its contents, and local application of agents to promote the granulating inflammation of the walls of the cyst, the obliteration of its cavity, and the shrinking of the walls of the sac.

Extirpation with the bistoury is the surest and quickest way, and ought to be used whenever the operation can be performed easily and without danger. Elastic ligature is advantageous for some pedunculated cysts. The other mode of interference includes several ways. For serous and most mucous cysts, the evacuation of the contents by a capillary puncture and the injection into the cavity of an irritating fluid (pure or diluted tincture of iodine, a strong carbolic solution) are at times sufficient; after the injection, especially if before the removal of the injected fluid the tumor has been kneaded by the surgeon, the wall of the sac has become inflamed and vascular, a sero-fibrinous exudation takes place; then gradually this serosity is absorbed, the walls of the sac retreat and the cavity disappears. The free incision of the wall of the cyst is another process which brings on recovery in a different manner: the cystic membrane, then exposed, loses its epithelium, suppurates, is covered with granulations which fill the cavity, thus constituting a more or less voluminous mass of embryonic tissue which afterwards becomes organized and contracts. Multiple punctures and capillary or tubular drainage bring on the same result; sometimes recovery is slow, but it can be stimulated with irritating injections into the cavity. Deep cauterization, which also gives good results, is especially advised when the walls of the cyst are thickened by previous unsuccessful treatments.

Sarcomas require early, entire removal, which even does not insure against their return. Still, recovery in numerous cases follows a single well-performed operation. When this is performed for sarcoma of soft parts, one must bear in mind that the fibrous capsular sheet, which ordinarily isolates the morbid tissue, is part of the neoplasm and envelops it

entirely. An iodoform dressing with or without drainage should follow. We have found no especial efficacy in arsenious acid; its so-called specific action on sarcomatous elements remains to be demonstrated. If there is a relapse, interference must be renewed as early as possible. Sarcomas of bones almost always return, even when resection extended beyond the limits of the neoplasm. In the case of small animals affected with sarcomas of the legs amputation is advised. *Melanotic tumors* should be operated upon only when they give rise to functional disturbances, interfere with deglutition, micturition, defecation, or with the work of animals.

With *epitheliomas* and *carcinomas*, radical and early removal is also the only treatment likely to arrest the disease; but interference is to take place only when the entire excision of the growth and ganglionary surroundings is possible. One should remove the neoplasm, the surrounding latent zone of infection, the indurated glands and those that are suspicious, and also the lymphatic vessels connected with the tumor. The excision should always be made freely, including even healthy structure; the edges of the wound should then be brought together by suture and an iodoform dressing, with or without drainage, be applied. Ulcerated epithelial tumors on the toes of dogs, ordinarily yield only to amputation on the metacarpal region; excision only of the diseased toe is insufficient. When total ablation is not possible, it is useful, in some cases, for instance where there is ulceration, to make a partial excision in order to facilitate the cleaning of the wound and relieve the pain (dog), but abstention is the rule. Interference is always to be forbidden in diffuse cancers, enormous multiple growths and in cases when infection is of generalized tendency.

The removal of *enchondromas* and *osteomas* should be performed only when the disease progresses rapidly and causes functional disturbances. *Enchondroma* of soft parts rarely returns after complete extirpation; that which develops in the superficial layers of bones is scraped off. If there is a relapse and the growth affects a bone of a leg, amputation is required in the case of small animals. Osteomas which cause no pain or interference are left alone.

With *lymphadenomas* abstention is the rule. The tumor returns in a short time or new ones develop in other regions. In supposed cases of cures of lymphadenomas by surgical interference, it is probable that the ailment had been given a wrong name. Internal arsenical treatment, recommended for lymphadenia, is powerless in domestic animals.

For *myomas* and *neuromas* which are painful and interfere with functions, extirpation must be attempted if not too difficult. Tumors developing on the nerves after neurotomy are not true neuromas, but chronic

inflammatory neoformations, which are at times accompanied with great pain or lameness, and must be resected. In general they can be avoided by giving to the wound of operation all the conditions required for immediate cicatrization; their return is prevented in the same way.

THIRD PART.

DISEASES SPECIAL TO EACH TISSUE.

CHAPTER I.

SKIN AND CELLULAR TISSUE.

I.

TRAUMATIC LESIONS.

EXCORIATIONS—CORES—STICKFASTS.

We shall say nothing of *bruised* or ordinary *cutaneous* wounds. Their treatment requires no special attention.

Excoriations, so frequently observed during the warm season on the parts of the body which carry the various pieces of harness, are ordinarily made by their direct action upon the skin moist with perspiration; the epidermis adheres to the harness, becomes loose, and the Malpighian and papillary layers of the skin are exposed. The uncomfortable itching following gives rise to repeated rubbing on the part of the animal, and becomes the frequent cause of complications when the lesion exists on the withers, the neck or the poll.

Very simple attention is necessary to obtain cicatrization. The injured region should be relieved of the pressure of the harness; if this is on an animal whose work can be stopped, it should be left for a few days in the stable; if it has to be kept at work, the saddle or the collar should be chambered or padded on each side of the injuring part of the harness to relieve the pressure. That removed, the excoriation becomes covered with a yellowish or brownish scab and rapidly cicatrizes. In case the lesion is extensive and looks bad, recovery may be accelerated by antiseptic lotions or epithems, or applications of vaseline or glycerine. Cocained vaseline can be used if the itching is very great.

The skin of the regions which are the seat of pressure or repeated rubbings—surfaces on horses which carry the harness, on cattle the yoke, and the plantar cushion of a dog's paws—present sometimes circumscribed epidermic neoformations more or less elevated, with irregular edges, analogous in their pathogeny to the *corns* of men; they are called *cores*. Surround-

ing them the hairless skin is covered with a dry, horny, hard and irregular patch, which results from the hypertrophy of the horny layer of the epidermis. Generally, the deep face of this core is flat, the mucous layer and the dermis remain intact or slightly altered; it is possible, however, that the papillary coat is involved in old and extensive cores, and that they remain even after the removal of the cause that has produced them. Except in rare cases, cores of our large animals are painless, and do not interfere with their use. It is not so with those of the paws of dogs; they have deep roots, which consume the papillæ, thin the dermis, and give rise ordinarily to severe lameness.

Cores due to the harness, most commonly giving rise to no serious impediment, are not treated; it is, however, important to prevent the increase of the trouble by improving the condition of the harness, with new padding, for instance. Painful cores must be relieved of all pressure. The thinning of the epidermic plate with the bistoury, and applications of vaseline, glycerine or salicylic collodion are ordinarily used. Cauterization with mineral acid or the excision of the cutaneous spot is seldom necessary.

In dogs, the cores of the paws are treated with paring, warm baths, and the repeated applications of salicylic collodion.

On the surfaces where the skin is much pressed by certain pieces of harness (saddle, collar, surcingle), spots of dry gangrene may develop, of which we have already spoken in the article on *Gangrene*, and which are known as *stickfasts*. This expression does not apply to epidermic growths, but, on the contrary, to lesions of necrotic order.

Their pathogeny is known; badly padded or improperly fitting harness presses hard on the skin and promotes a permanent ischæmia and cellular disturbance, which end in mortification of a more or less extensive cutaneous spot, generally circular in shape. If the pressure continues, the tegumentary spot, which is necrosed, dried and hardened, transmits it to the tissues underneath, which in turn become successively necrosed; thus is explained the formation of the deep stickfasts of the withers, of the neck, and of the poll, accidents that we shall consider later.

The sloughing of the mortified skin takes place as in all cases of limited dry gangrene. It rarely requires more than twelve or fifteen days, when the necrosis does not extend beyond the subcutaneous connective tissue. The wound heals by granulation.

Stickfasts are prevented by watching the condition of the harness and its paddings. As soon as the mortification sets in, its spreading is prevented by removing the pressure made on the spot; the animal should, according to the case, be kept out of work for a certain length of time, or the harness should be so altered as to prevent any further mischief. Though this may often be sufficient, it is better to accelerate the cure by

the application upon the diseased part of vaseline simple, or mixed with an antiseptic substance (cresyl, carbolic or boric acid). If there is pain, cocaine preparations should be used.

To stimulate the sloughing of the stickfast, vesicating preparations (simple blister, mercurial or bi-iodide of mercury ointment) are often used. These agents stimulate the progress of the inflammation, and noticeably relieve the pain when it is great. The sloughing completed, cicatrization of the wound follows soon afterwards. At times a certain sensitiveness remains in the region where it took place; this gradually diminishes, and its disappearance can be hastened by a slight blister.

On the superior border of the neck, on the surface of the implantation of the hair of the mane, there appears sometimes, after an eruption of acne, a certain number of little necrotic spots on the superficial layer of the skin. These have their seat principally in the bottom of the cutaneous folds that are found in some horses at the boundaries of the neck and the withers. They are very painful during the time required for their elimination (Bouley and Nocard).

These miliary necrotic spots of the neck are generally found in animals that are badly kept. Their skin is generally covered with a greasy substance, irritating, and formed of epidermic detritus, dust and fluid exudations. A thorough washing with soap and tepid water is first to be prescribed; this should be followed by applications of vaseline, mercurial ointment or a vesicating friction of mercurial blister, in order to stimulate the sloughing of the necrosed skin. After five or six days this should be assisted by frequently repeated warm fomentations, and afterwards by simple or iodurated glycerine. In the generality of cases, a cure is obtained by simple cleansing of the skin.

II.

ERYTHEMA.

It is of rare occurrence in large animals, where it is seen only on hairless surfaces, but is quite common in animals whose skin is free from pigment (sheep, pigs, cats and dogs). It may be seen on any part of the body, and is characterized by a congestive redness which temporarily disappears under pressure, and by a rather strong itching. The region is soon hot and tumefied, and cutaneous sores and suppurations may follow.

When erythema is produced by mechanical causes (pressure, friction, clipping), or by chemical (irritating therapeutic applications), it is circumscribed; on the contrary, it is ordinarily diffused when it is due to

thermic irritations. Solar erythema, frequent in tropic regions, assumes this latter form.

In horses, swine, and especially sheep, under the double influence of feeding with buckwheat and exposure to the sun, a diffuse erythema may develop, often complicated with bullate, phlegmonous or gangrenous dermatitis. Upon cattle and sheep fed on buckwheat, and having vesicular cutaneous eruptions, Wedding observed that the lesions were so much the more marked as the subjects had less pigment, were whiter, or were exposed to direct solar or diffused light. Animals that were kept in the dark did not have any eruption. Piebald-colored animals were not affected, except on the white parts of their tegument. A cow covered with tar on one side of the body took exanthema only on the other side.[1]

The treatment, above all, must be prophylactic; it has various regulations. Clean the skin, prevent its mechanical irritation, guard the animals against a too hot sun, keep them under trees or in places where they are not exposed to reflections of the light, protect the head with a hood, cover the parts with vaseline, or use the decoction of henna (*Lawsonia inermis*), with which Arabs dye the white regions of the body of their horses and protect them from solar erythema.[2]

When erythema is due to feeding on buckwheat, this must be changed, the animals kept out of the sun, and taken out only in the evening or in cloudy weather. The disease has a natural tendency towards resolution. This will be promoted by astringent lotions (acetate of lead, tannin, sulphate of iron) or by cold irrigations. Applications of glycerine, vaseline with boric acid, lead and zinc salts are used. Often it will be sufficient to dust the erythematous surface with starch. If the itching is severe, cocained vaseline or nitrate of silver solution, 5 per cent., can be used.

Extensive œdemas, subcutaneous phlegmons and cutaneous gangrene are possible complications. Severe erythematous inflammation of the skin demands the use of antiphlogistics (irrigations, cold compresses), or of disinfecting solutions, when the phlegmasia is suppurative or gangrenous.

The erythema which occurs in horses, on the axilla or the groin, under the influence of work when the skin is covered with perspiration and dust —*intertrigo*—gives way rapidly to the simplest treatment: rest, washing the parts with tepid water, dusting them with starch or starch and subnitrate of bismuth. When the exudation has disappeared, the dry, scaly skin must be covered with vaseline or glycerine.

[1] *Finsen*, Semaine Medicale, 1894, p. 302.

[2] *Boisse*, Bulletin des Veterinaires de l'Armée, 1887, p. 119.

III.

DERMATITIS.

Eczematous dermatitis is met in all species of animals, presenting itself with peculiar localizations and modalities. It is most frequently seen in dogs. Generally speaking, it must have both local and internal treatment.

For the local treatment one has the choice of numerous agents; of these, however, some are more especially for certain forms or stages of the affection. Incipient eczema demands only the following treatment: Protect the skin from all causes of irritation; cut the hair on the diseased surfaces and cover them two or three times a day with absorbing powders (starch, subnitrate of bismuth, oxide of zinc). On dogs, eczema patches have often a very disagreeable odor; fancy and pet animals may have these patches covered with essence of rose or benzine. At this stage of the disease, vaseline mixed with zinc oxide or boric acid can be used with advantage. For papular eczema, the treatment is the same. If the itching is severe, alcoholic watery lotions combined with a small quantity of carbolic acid (1 per cent.) is to be prescribed. The use of absorbing powders is still the best local therapeutic measure for various modalities of moist eczema. Mixtures of powders of tannin and iodoform (10 to 1), or of cresyl and boric acid (3–4 per cent.), give good results. In some cases, light cauterization with a solution of nitrate of silver (5–6 per cent) or nitric acid (1 in 10) produces an excellent effect. If eczema is impetiginous, one must, by slight squeezing, press out the pus gathered under the crusts, wipe them well, and then cover them with antiseptic ointments. Scaly forms demand other treatment. Tar, cresyl, oil of cade, naphtol ointment, iodized glycerine, are to be recommended. Solutions of cresyl (2 per cent.), and of sulphate of iron or copper (1 per cent.), are also used. The substances patronized lately (ichthyol, resorcin, anthrarobin) are not more active than the preceding. In all cases where eczematous disorders are exclusively due to mechanical causes, the local treatment is generally sufficient. But most commonly the general health of the patient is not good, so that an internal medication has to be started. Bicarbonate of soda, iodide of potassium, arsenious acid or Fowler solution are the principal agents. At times chronic eczema gives rise to a true warty dermatitis; then the tegumentary vegetations must be amputated with the bistoury or scissors, and then cauterized with nitric acid or the actual cautery. We may mention the important influence that, in some

species, especially dogs, hygiene, food and condition of life may produce upon the genesis and march of eczematous affections.

On the surface where flexion takes place in the lower articulations of the extremities, one observes, often in horses, a dermatitis, the principal determining causes of which are the irritation produced on the skin by cold water and mud, manure, dust or the application to these surfaces of ointments made of lard or of vesicating preparations (blister on the fold of the hock or of the knee); this dermatitis is sometimes under the influence of an eczematous diathesis. The skin tumefies, becomes warm, painful, and covered with vesicles, which ulcerate; a serous, yellowish fluid exudes from the papillary layer, which, when the animal moves, cracks and forms fissures more or less deep, whose edges lose their hair and become indurated. The fluid secreted by these wounds dries on their surface, forming yellowish crusts. These cutaneous cracks (scratches) are not localized on the hollow of the fetlock only: they appear sometimes behind the canon and alongside the tendons.

Whatever be the seat of these lesions, ordinarily the leg is swollen, and complications of lymphangitis are frequent in recent scratches. The pain and the lameness, which are sometimes very great in nervous animals, are not so prominent in low-bred creatures. The transverse fissures of the knee (*malanders*) and of the hock (*sallenders*) assume, in some cases, a scaly form, and are transformed into callous wounds. The fissures (scratches) of the canon and fetlock may terminate in the same way; sometimes they give rise to hypertrophic dermatitis.

The prophylaxis of these affections consists in keeping the lower regions of the extremities thoroughly clean, in protecting the skin from long contact with dampness, mud or irritating liquids, and in not covering the fold of the joints with vesicating preparations or greasy mixtures, which become rancid, irritate the skin and dry on its surface. "The practice of clipping the hair of the fetlock in winter and during the rainy season is the cause of many scratches. On this account, advice should always be given not to do this in winter on horses which in working are obliged to stand in mud or are kept outdoors a long time" (Weber).[1]

When the hairs of the extremities are clipped, the legs ought to be washed with tepid water and well dried before the animal is returned to its stall.

The curative treatment varies with the stages of the disease. A most varied assortment of drugs has been recommended: poultices, tincture of aloes, iodated glycerine, white lotions, egyptiacum and the Villate solution all have their patrons. To all those agents we prefer careful disinfection

[1] *Weber*, Bulletin de la Soc. Cent. de Med. Vet., 1889, p. 314.

of the part, with as complete an immobilization of the diseased region as can be obtained.

If the patient has to be kept at work, the skin should be washed morning and evening with a tepid antiseptic solution and covered with a coat of creolinated or borated vaseline. Applications of lead or zinc are less efficacious. If the exudation is abundant, absorbing powders (starch, tannin, charcoal, oxide of zinc) are useful; after the washing in the evening, a thin coat of these should be dusted over the diseased parts. When the animal is left to rest, antiseptic dressings bring on a rapid recovery. The wounds are disinfected with a tepid cresyl bath; then, when thoroughly dried, they are dusted with iodoform, covered with iodoform vaseline and a wadding dressing, which should extend up the leg to reduce the movements of the lower joints as much as possible. Cagny disinfects the wound with chloride of zinc (1 in 10) and applies a coat of Socin paste.

When scratches have existed for some time, one must likewise employ antisepsis and immobilization. We may add that since this disease is sometimes related to eczema, an internal treatment is useful. Bicarbonate of soda (20 to 30 grams a day), but, above all, arsenious acid in from 50 centigram to 1 gram doses, are the agents that give the best results.

Recent malanders and sallenders require the same treatment. When they are old, they must be treated as callous wounds.

Papular dermatitis of the legs of horses is a common affection in some countries, more frequent during extreme seasons than in intermediate periods. It is always localized on the extremities and rarely extends beyond the knee or the hock.

The digital region, the fetlock and the canon are swollen and painful; numerous papillæ appear on the skin, and crusts are formed on their surface, which become loose and slough, leaving small hairless spots. We have seen them sometimes extending to the forearm and to the shank.

This affection, the causes and nature of which are not well known, is without serious gravity and leaves no mark. It lasts only from three weeks to a month, and the affected animals can be kept at their work.

A few tepid washes and daily cresyl lotions (2 per cent.) are always sufficient, even when the eruption is accompanied with quite large swellings. If fissures and cracks of the skin occur, wadding dressings are advantageous.

Œdematous dermatitis, also called *warm œdema*, is commonly observed during summer in the regions where the skin is exposed to the irritation of the harness, more especially the withers, where it is produced by the saddle. Let the harness fitting badly shave the skin, compress it or bruise

it, or let the tegument, moist with perspiration, adhere to the harness, or loosen with it, lacerating the subcutaneous connective tissue, then a phlegmasia involving the skin and that tissue will develop, the region will become swollen, hot and more or less painful.

All the treatment to be given is to suppress the cause of the disease, and if the epidermis is still intact, to apply cold or astringent lotions (white or alum solution). After a few days resolution is complete. If it takes place slowly, massage in the direction of the hair will stimulate it. When the skin is excoriated, antiseptic lotions and applications of borated, carbolated or iodoformed vaseline are used. In the rare cases of œdematous dermatitis, severe from the start and ending with the formation of a subcutaneous abscess, this must be opened early and treated as ordinary suppurating collections are. (See *Abscess.*)

The *chronic phlegmonous dermatitis*, which seems peculiar to dogs, is ordinarily localized on small surfaces. It is observed most commonly on the lips, the sheath, the elbows, the hock or the digits. Danish dogs, large dogs and short-haired breeds are more exposed to it than small dogs.

It is characterized at first by a tumefaction of the skin, on which the hair falls off ; it suppurates and shows an abscess very similar to that of follicular mange. While in this latter, however, most of the small purulent centers are whitish, in simple phlegmonous dermatitis all have a bluish-red tint, and the thin cutaneous layer which forms their external wall is shiny and has contents of a bloody appearance. These abscesses are followed by fistulous tracts which give escape to pus mixed with blood.

Generally the disease progresses slowly. It may remain stationary for months; in some instances it covers extensive surfaces and is complicated with fatal results. We have observed a dog in which the disease started at the sheath, extended to the groin and the right thigh, and gave rise to fatal peritonitis. Cultures of the pus, taken from the abscesses of the sheath and from the thigh, as well as that of the peritoneal effusion, produced colonies of staphylococci (*staphylococcus pyogenes albus* and *aurens*). In some cases where the lesions were circumscribed, we have isolated the same micro-organisms.

This phlegmonous dermatitis is tenacious and obstinate to treatment. We have used against it numerous agents without much success. Disinfection of the skin with antiseptic lotions, puncture of the purulent centers, cauterization of their walls with chloride of zinc or nitrate of silver and applications of tincture of iodine will sometimes succeed. When the patches are small and few, excision and an iodoform dressing are the preferable treatment.

Gangrenous dermatitis has a complex etiology. It is frequently the termination of severe cutaneous, traumatic, toxic or infectious phlegmasias which have not been controlled. Solar erythema, feeding on damaged food altered with fungi, may promote it (Friedberger and Fröhner). Gangrenous dermatitis of extremities—cutaneous quittor—so frequent in horses during winter, is due especially to the action of cold (freezing) mud on the skin.[1] Irritating liquids (urine), caustics, traumatisms and especially blows that animals give to themselves may bring on the same result. The swelling of the hind extremities predispose to this affection (Chenier). As soon as the integrity of the skin is destroyed, the action of the bacteria, added to that of the other pathogenous causes, increases the inflammatory process and brings on gangrene.

The diffused tumefaction and soreness of the region, the bristling of the hair, the oozing of the skin, the dark coloration of the diseased parts when free from pigment, all indicate the severity of the phlegmasia and the threatening gangrene. In cases of cutaneous quittor, the inferior part of the leg is tumefied more or less and the swelling extends at times above the knee or the hock. The sensibility and the lameness are more or less pronounced according to the degree of inflammation. On the inflamed part there soon appear "small elevations which spread open and allow the sloughing of necrosed pieces mixed with pus and blood" (Barthe), or moist cutaneous patches partly mortified or already gangrenous. It is not rare to detect in the centers of these patches deep fluctuation, indicating the existence of subcutaneous suppuration.

The preventive treatment depends upon the etiology. At times the feed has to be changed (solar erythema), or again, the numerous causes of irritation upon the skin must be prevented or attenuated. For cutaneous quittor especially, the hair of the lower parts of the extremities should not be dressed (clipped) during cold or rainy weather (Weber), and the legs should be carefully attended to (tepid washing, drying, application of an isolating, greasy substance, in cases of work in freezing mud). Swollen, elephantiasic legs, whose tissues are predisposed to necrosis, require special attention. (See *Frost-bites.*)

Against incipient dermatitis, the means indicated in the chapter on *Inflammation* should be used. Friedberger and Fröhner recommend an ointment of lead and tannin, or antiseptic vaselines. We generally use antiseptic baths twice a day, with bandages wet in the same fluid. Scari-

[1] Several years ago we saw a true epizooty of this affection among the horses of the railroad companies in New York, caused by the free use of salt to melt the snow in the streets. We have seen animals in which the entire skin had sloughed on the whole inside of the legs from the feet up to the groin; others where the entire abdominal wall was bare of skin.

fications are sometimes useful. If fluctuation is present, early opening is to be advised, as by it and antisepsis, complications and gangrene at times are avoided.

If mortification already exists, the treatment must be that of moist gangrene. The wound resulting from the cutaneous slough should be carefully disinfected with baths of tepid water and covered with an antiseptic dressing. We prefer iodoformed, cresylated or carbolated vaseline to old ointments. Before antisepsis, when cutaneous quittor was treated with greasy substances or poultices, complications were frequent; a serious lymphangitis often followed; or a tendon, a synovial sac or one of the fibro-cartilages of the foot would become involved. If modern therapeutics has not removed all those serious accidents, their frequency is at least considerably reduced.

Contagious pustular dermatitis of horses, generally limited to regions upon which the harness or blankets rest, may exceptionally extend to the whole surface of the body. It is characterized by small isolated or collected pustules varying from the size of a pea to that of a bean. After a few days these pustules burst, their contents dry up and form yellowish scabs, which soon drop off. In the light forms recovery is complete in two or three weeks; in severe cases the very numerous pustules are followed by ulcerations at various depths; lymphangitis makes its appearance and the surrounding glands sometimes enlarge and suppurate. Purulent centers may also develop in the affected region. All these are not very painful, the itching is slight or even absent, and the general condition is not at all altered.

Contagious and inoculable, produced by a specific bacillus, this dermatitis is transmitted by harness, blankets and tools for cleaning. The period of incubation varies between six and fifteen days.

Isolation of the sick, disinfection with boiling water or corrosive sublimate solution of harness, blankets, stables, etc., are the two principal requirements for prophylactic treatment.

All care should be taken to avoid the dissemination of the bacillus upon the skin of regions which surround the acneic regions. In the beginning lotions of corrosive sublimate (1 in 1000), cresyl (3 per cent.), sulphate of copper or zinc (2 per cent.) (Trasbot) should be applied. When the crusts are formed, they can be scraped off, removed, and applications made of vaseline mixed with carbolic acid, corrosive sublimate or iodoform.

Verrucous dermatitis of the horse, the morbid affection, commonly called *grease*, consists essentially of a chronic, exudative and hypertrophic inflammation of the skin of the inferior regions of the extremities. It was very common in past times, but with the progress of hygiene it has become more and more rare. As in the past, it is principally observed on

the hind legs of low-bred horses having long hair and working in the mud and dampness. The pathogenous action of dampness, manure and irritating fluids is no longer discussed.

Between this affection and chronic verrucous pododermatitis (canker of the foot) there are close relations, and they seem to differ only in their localization. What is known of its nature, however, is sufficient to suggest a strong and sure treatment. While some authors consider it as an affection entirely local, and many as a common eczematous manifestation, it is related to a general morbid condition (lymphatism, arthritism). The frequency of the disease on several extremities together, and the resistance it offers to the treatments used to prevent it, are serious arguments in support of this last opinion.

The preventive treatment rests altogether on the etiology: avoid prolonged action on the skin of the legs of mud or irritating fluids; dress at once and with care all wounds, fissures, scratches and cutaneous phlegmasias of those regions.

As soon as the disease is developed, a local active treatment is required. To name all the means recommended would be tedious. Let us consider only the principal ones.

Although the acute phenomena and lameness are often missing, there are cases in which the inflammation of the skin is very pronounced. This was overcome in the past by bleeding, emollient poultices, a seton on the thigh or on the chest; now it must be treated with tepid antiseptic lotions or baths. Twice a day a lukewarm soaking of cresyl (2–3 per cent.) or of sulphate of copper (3–4 per cent.) should be given. Between these, the regions should be covered with bandages moist with a similar mixture; soon the inflammation will subside, the region becomes cleaner and the secretion diminishes. Apply astringents or slight caustics. Many practitioners prefer the lotions or the dressings of Villate solution, or of sulphate of copper (4–6 per cent.). Möller recommends the mixture of sulphuric acid and alcohol (1 in 10–20) applied as dressings. Prangé's mixture (alum 125, sulphate of zinc 125, arsenious acid 10, sulphuric acid 5, water 1000), the caustic liquid of Veret (sulphate of copper 10, sulphuric acid 12, vinegar 78), that of Delabère-Blaine (corrosive sublimate 30, 22° alcohol 30, water 1 liter), have their patrons. All may be used with advantage if antiseptics have been applied previously.

With the precaution of keeping the animal from the continued action of water or mud, moderate work is advantageous.

After recovery, relapses are avoided by good hygiene, cleanliness of the places where animals are kept, attention to the clean condition of the extremities, and by the administration now and then of internal treatment.

Many foreign authors continue to consider as a *special dermatitis* the

various cutaneous localizations of horse-pox. The various forms of this affection have been known since the observations of Lafosse and Bouley. At times the eruption is generalized, and pustules in varying numbers exist on the skin, which are isolated in some regions, agglomerated in others, and sometimes localized in one region, or again in several. Frequently it occurs on the inferior parts of the legs, giving rise to that form of phlegmasia which, towards the end of the last and beginning of the present century, English farriers called *grease*, and which Jenner has named "shore-heels." Extending over large surfaces, it resembles *acute grease* (*eaux-aux-jambes aigues*); sometimes it is added to some recent or old lesion, to a wound of operation, to necrosis of the scutiform cartilage or of the tendons, and may be supposed to be an erysipelatous outbreak; again, in other cases it is confluent on the inferior parts of the head, on the skin of the lips, of nostrils, on the pituitary membrane, and is accompanied with lymphangitis or adenitis, and these present a clinical aspect which at first may make one believe it farcy or glanders; it is also that which, when located upon the buccal mucous membrane, constitutes the disease described under the name of *contagious pustular stomatitis*.

Lafosse and Bouley have shown, by inoculation of cattle, the true nature of this eruptive affection with so many manifestations: the fluid of the pustules, inserted in the skin of heifers, has produced vaccine.

The cutaneous phlegmasias produced by horse pox may affect lymphatics in various degrees, but their typical progress, their peculiar characteristics and their short duration render the diagnosis easy. Even on the fetlock or the coronet it is easy to differentiate the eruption of horse-pox from gangrenous dermatitis (cutaneous quittor) from scratches or from "grease."

Since the disease is very contagious, prophylactic measures are important. Avoid the transportation of the virulent serosity by means of instruments used for cleaning the animals. The cyclic evolution of the eruption, and in the generality of cases its benignity, disprove active interference. Ordinarily it is sufficient to watch the progress of the disease and attend to the complications that may appear, such as lymphangitis, adenitis, etc. The application of absorbing or antiseptic powders at the stage of exudation and in the cases of acute inflammation of the skin of the lower parts of the extremities, rest, carbolic or cresyl warm baths and wadded dressing constitute all required therapeutics.

Möller advises dusting the diseased parts with a mixture of tannin and iodoform, or covering them with an ointment of paraffin and red oxide of mercury with a wadded dressing, which is left for a variable length of time, according to the amount of suppuration.

III.

ELEPHANTIASIS.

Elephantiasis is not a simple morbid entity, but a lesion common to several affections. In animals we do not observe the enzöotic form that "human" physicians find in filariosis. The form which attacks horses corresponds to that known in man as *Arabian elephantiasis*. The disturbances of the venous or lymphatic circulation, or of both, are the ordinary causes.

The onset of the disease varies: at times it occurs immediately after an attack of acute lymphangitis whose resolution has been incomplete; at others it succeeds the local swellings accompanying suppurative lesions of the skin (furuncles, scratches), or at others seems to come at once without any apparent lesion of a venous or lymphatic nature, and develops slowly. In all cases the process consists in a "hypertrophical fibrous dermatitis with sclerosis of the skin and connective tissue."

In horses, elephantiasis is especially common to the hind legs, localized on one or affecting both; it is also seen on the fore legs, or on other regions, principally the sheath or the lips.

The diseased parts are the seat of a chronic phlegmasia which will not disappear. Besides the acute manifestations that may appear, the swelling is evenly hard and painless; it increases by rest and diminishes by exercise. In the hind legs, the hypertrophy is sometimes limited to the fetlock and the phalanges; often it extends to the fetlock, and in some cases goes higher, to the shank. Ordinarily, the swelling is uniform, the leg hypertrophied as a "regular cylinder," the skin is tense, hard, smooth, without inflammatory spots or fissures or epidermic abrasion. Inflammatory manifestations may occur and abscesses develop in the thickness of the dermis. When the affection is old and the leg enlarged, projecting ridges are seen on the hock, fetlock and coronet. The affected leg may assume considerable size and weight; in a case of elephantiasis of the hind leg in a horse, Siedamyrotzky has seen the hock measuring 75 centimeters around and the fetlock 65. Burmeister has dissected one leg which was so large that the subtarsal region weighed 50 kilos (100 pounds).

Wounds of the extremities, scratches and lymphangitis are rarely complicated with elephantiasis when a wadded dressing immobilizes the region and prevents the soiling of the wounds and the chronic inflammation of the skin and connective tissue.

The disease once established has no tendency towards resolution: all means used against it fail. It is said to be the more serious and obstinate the more rapidly it develops. Whatever its mode of development, we have almost always found it equally tenacious.

Ointments made of lard, which irritate the skin and promote the dropping of the hair, should be avoided. Alteratives, blisters, actual cauterization, not only are of no benefit, but their action is most often injurious; in the few cases where we have tried them they have invariably produced an increased activity of the hypertrophy. Scarifications are followed by the escape of a little quantity of fluid; the *sclerosis* is greater than the œdema. Disinfection of the skin and keeping it in perfect cleanliness, slight massage and compression constitute the whole treatment. Abuse of baths and douches is injurious. Compression is made with flannel bandages or elastic rollers: it should be intermittent and tightened to a moderate degree; if it is too loose it will produce no effect; too tight, it may bring on cutaneous gangrene. With some patients, the latter can be produced very readily; we have several times seen sloughs made by a rubber band moderately tightened. To resume, one should advise moderate work, medium massage and the application, for the night, of a rubber bandage rolled from below upwards round the leg and wrapped in a pad of oakum to regulate the pressure: the leg should be kept strictly clean, frequently washed with tepid water and dried. *Light* elastic pressure should not continue more than ten or twelve hours.

Lymphangitic manifestations and abscesses that sometimes occur, demand other means of treatment. (See *Diseases of the Lymphatics and Abscesses.*)

Under the name of elephantiasis has been described an affection of cattle very different from that of the same name in the horse. It begins with dulness, inappetency, febrile symptoms; the skin becomes tumefied on the dewlap, under the abdomen and on the legs, then the knee and hock. The nose, ears and eyelids are soon œdematous; ulcerations appear sometimes in the mouth and in the nose, accompanied with a flow of thick and fetid saliva or a more or less abundant nasal discharge. Soon fissures appear on the diseased parts, the skin dries up, the hair falls off. Some animals die; but generally the wounds heal and the animal recovers, but remains thin. The thickened skin is covered with furfuraceous scales; in some cases the hair does not grow any more. Zundel considers this as a special form of contagious catarrh. For Cadéac, it is a variety of anasarca.

Cruzel has for a long time tried numerous pharmaceutical products. Arterial bleeding, however, nitrated drinks, but especially frictions with spirits of turpentine, repeated several times a day on all tumefied parts of

the skin, seem to be the most advantageous treatment at the beginning, and when there are no cracks on the skin. Cadéac recommends the treatment used in anasarca: at the very outset, before the appearance of the swellings, bleeding gives the best results; later, the sulphate of soda, alcohol, wine, nitrate of potash, scarifications and vapor baths. Irritating frictions (charges, ammoniacal liniment, spirits of turpentine) made on the swellings might be used.

If gangrene occurs, the sloughing of the eschars is to be assisted, and the wounds following to be dressed antiseptically.

V.

ACNE.

The papulo-pustular eruptions due to the inflammation of sebaceous glands of a non-specific nature are met in subjects of the various domestic species, but more frequently in horses and dogs. Produced by multiple causes, they seem to be especially the result of mechanical irritations to which the pilo-sebaceous follicles are particularly sensitive.

In horses recently clipped, it is common to observe, on the regions supporting the harness, confluent patches of acne. Short, rough hair transmits the pressure to the hairy bulbs, act as irritating thorns, and thus promote a papular or pustular inflammation. On the superior border of the neck, where the collar rests, the hair of the mane, cut very short, may also irritate the pilo-sebaceous follicles and bring on an eruption of acne, which may be complicated with extremely painful cores. (See *Cores.*) In dogs, acne may be seen in the most different regions; sometimes, in serious cases, it becomes generalized. It is rare in ruminants.

When the cause of acne is known, the first rule of treatment is to relieve or remove it. On horses, soft pads should be placed between the harness and the diseased part. Since dirt keeps up the disease and promotes its spreading, repeated tepid antiseptic washings should be given, and after careful drying the parts should be covered with glycerine, carbolated or borated vaseline. When the disease is recent, these means are sufficient. On old cases, when the skin is indurated, mercurial ointment can be advantageously used.

In the case of dogs, for recent acne, salicylic lanolin (salicylic acid 20, lanolin 80–100) is better; but for old acne, cresyled boric acid (creoline 1, boric acid 40). Before their application, the purulent pimples should be opened and the diseased surfaces well cleaned.

VI.

FURUNCLE—ANTHRAX.

Circumscribed infectious inflammations of the skin, ending in suppuration and the formation of sloughing cores, are somewhat common in animals. In furuncle, the inflammation is limited to small cutaneous spots: the tumor resulting from it is small, conical and very painful; it suppurates and is followed by the slough of its necrosed center. Furunculosis is observed in all domestic animals. Zundel has observed it in horses which, having been accustomed to good care and little work, have been called to heavy service; in army reformed horses, in animals which after working for grain and seed dealers have been disposed of, and also in reduced and exhausted animals. We have often observed it on various parts of a dog, and on horses on the lower parts of the hind legs.

Ordinary *anthrax* is but a voluminous, diffuse furuncle; extending to the subcutaneous connective tissue, or an inflammatory tumor formed by confluent furuncles. Like the generality of human surgeons and of foreign veterinarians, we have no hesitation, notwithstanding the etymology, to apply this word to lesions which have nothing in common with anthrax (charbon).

Bacteriology has shown that furuncle and anthrax are promoted in man by the same micro-organism, the *staphylococcus pyogenes aurens*. In the furuncle "the infectious organism enters by the opening of a pilo-sebaceous follicle . . . if several neighboring each other are affected the furuncle becomes an anthrax" (Broca).

Basilicon ointment, mercurial frictions, laurel ointment and poultices must be left aside. The disinfection of the region carefully made, first with soap and water, then with tepid antiseptic solutions (corrosive sublimate, carbolic acid or cresyl), and above all, lotions or atomizing vapors of these solutions and also warm compresses (50°) covered with an impermeable protection, constitutes the best treatment of the furuncle. These antiseptic compresses have all the advantages of poultices and none of their inconveniences. With them pain subsides, redness diminishes and the lesion is circumscribed. For inferior regions of the legs antiseptic baths are to be particularly recommended; they can be given two or three times a day and their action completed with compresses.

In the case of anthrax the preceding form of treatment may be followed alone or preceded by the early incision of the tumor, according to the seriousness of the lesions. If purulent collections develop in the neighbor-

hood they should be opened as early as possible and properly dressed. Free incision and drainage are sometimes useful. Thermo-cautery will arrest the hemorrhage and prevent auto-inoculations. (See *Abscess.*) Sometimes a general treatment is required. Purgatives and arsenic seem of little advantage. Cresyl and naphtol are good in some cases.

VII.

SEBACEOUS CYSTS.

These are seen with varying frequency in all domestic animals and on any region of the body. In horses they are most frequent on the nose, in the false nostril, the lips, the ear and the sheath. Their origin is still in doubt; the majority of authors say that they are due to the accumulation in sebaceous glands of the product of their secretion; but one may exceptionally observe them on the buccal mucous membrane and on that of the lips, where there are no sebaceous glands: perhaps these are cases of epidermic occlusions. The first cause is the obliteration of the orifice of the duct common to the hair and the sebaceous follicles, produced either by dried epidermic scales or by inflammation. The size varies from that of a hazel-nut to a large nut. They are round, perhaps a little flattened, depressed in the center, well defined in their surroundings, painless, of various consistency, most commonly puffy, more or less resistent, at times fluctuating or again of an uneven consistency, very hard in some places, very soft in others. The contents, formed of epidermic cells and greasy substances, vary in their aspect according to the proportion of the constituent elements; generally it is a caseous mass, at times a solid substance analogous to solidified fat (steatomatous cyst), at others it is a matter looking like honey (melicerous cyst).

If the positive diagnosis in some cases is quite difficult, it is of secondary importance: the sebaceous cyst cannot be mistaken only for affections requiring the same mode of treatment—puncture or removal.

Simple puncture is always insufficient; it permits the evacuation of the contents, but the wound heals rapidly and the growth returns. Repeated punctures followed by irritating injections (tincture of iodine 1–3, chloride of zinc 1–10) are often sufficient to obtain recovery. We succeeded with this treatment in the case of two large cysts of the false nostril. Potential caustics used after the evacuation of the contents are also somewhat successful. Ablation is the best way, however. After incision of the skin the mass is enucleated with the bistoury or the director, carefully avoiding the opening of the sac. With antiseptic care the cicatrization of the wound is rapidly obtained.

VIII.

CUTANEOUS HORNS.

Abnormal projections are sometimes observed on animals in various regions, but more particularly on the head. They are hard, formed of keratinized epidermic cells, and known as *cutaneous horns*. Generalized horns have, so far, been observed only in men. In animals—horses, cattle, sheep, dogs and cats—only cases of single horns have been recorded. Although their chosen spot is the head, they also grow on the back, flank, abdomen, and on the legs. They are of various lengths and sizes, straight or curved, smooth or rough. In parts exposed to repeated rubbings neoformations similar to them may be observed. (See *Hygroma of the Knee.*) Some of these productions fall off after several months, but are soon replaced by others. The others remain permanently.

While in mammifera cutaneous horns are the expression of a horny hypersecretion due to causes which cannot be determined in some species of birds, especially in parrots, it is common to find on the cheeks or other regions of the head, on the buccal mucous membrane, on the trunk and the extremities, horny productions of a tuberculous nature. Since attention has been drawn to these singular tuberculous neoformations we have met with several cases. In these the bacillus of Koch promotes the keratogenesis. Krampf has reported the case of a phthisical parrot which had on the right cheek a horn measuring two centimeters at its base and five centimeters in length. (See Fig. 56.) Megnin has recently reported a similar case.

The only efficacious treatment is extirpation. If cutaneous horns are only sawed off they grow again. They must be removed entirely, and the portions of perverted skin where they are must be excised, or, as recommended by some, destroyed with caustics. The use of the bistoury is better. (For the treatment of cutaneous horns of the parrot, see *Tuberculosis.*)

The *ichtyosis* observed in calves by Numann, Gurlt, Pangoué, Goubaux, consists of a general hypertrophy of the epidermis. The skin resembles that of an alligator. There is no treatment for such an affection. All the calves which were affected with it died a few days after birth.

IX.

TUMORS.

Cutaneous papillomata, common to animals, are more frequent in horses and cattle than in other species. They are observed on all regions, but those which are most affected are the head, the inferior face of the trunk, the genital organs, and the internal face of the legs. In horses, donkeys and mules, papillomata sometimes exist in great number, so that they can be counted by hundreds over the surface of the body. On a cow treated by Lehnert their weight amounted to twenty kilos. They vary in size from that of a pea to that of a nut, and sometimes form masses as big as the fist.

Although these tumors are not serious in themselves, they are much exposed to traumatic action, bleed easily, become inflamed and secrete a purulent fluid which dries on their surface or putrefies and has a fetid odor. They may also interfere with the motions of the animal or with other functions, and when they exist in great numbers they soon have an evil effect on the general condition.

The considerable number of warts which sometimes exists on one animal has suggested the admission of a "papillomatous diathesis." Hertwig has claimed that these productions were hereditary. It has been supposed that secondary tumors sometimes develop in parts soiled by the blood of a primitive growth. Their contagious nature has been admitted for a long time by outsiders. Majocci, Cornil, and Babès have found in them a special parasite—the *bacterium porri*.

In young animals it is not rare to see warts disappear spontaneously, even when they exist on comparatively wide surfaces. The same termination of these may be observed at all ages. Lübke has related the case of a thirteen-year-old horse covered with warts of all sizes, which dropped off without any treatment, leaving wounds which cicatrized regularly. But these spontaneous recoveries are exceptional, and when warts are numerous, voluminous, or when they simply interfere with functions, they demand an active treatment. The internal therapeutics (calcinated magnesia, arsenious acid, mercurials) succeed only with benign ephemeral forms or with those whose time of recovery has arrived. If magnesia given in doses of 0.50 centigrams to two grams a day seems to bring on the slough of the labial warts of the dog, we know that they disappear spontaneously; and the case of Lübke, to which many others could be added, shows that the result will be the same for cutaneous warts wherever they may grow.

The only efficacious treatment of permanent warts is their destruction

with caustics, ligature or the bistoury. Sulphuric, nitric, muriatic, acetic or chromic acid can be used. After scraping the superficial layer which covers them the caustic fluid is applied on the top of the growth with a glass or wooden rod, being careful not to touch beyond the outlines of the affection. The cauterized layer dries off and sloughs after a few days. The cauterization may be repeated several times. Arsenious acid and several arsenical products, used as powders, dusted on the surface of the warts, brings on mortification and sloughing. Boudeaud has recommended repeated applications of the following preparations:

	Grams.
Arsenious acid	5
Sabine powder, Pulverized gum-arabic, āā	10
Simple cerate	36
Corrosive sublimate	1
Resinated collodion	30

In the case of large animals, where the treatment must be quick and economical, the best way is to remove these tumors with the ecraseur, the bistoury, or to burn their bases with the red-hot iron. In dogs, silk ligature is preferred, or slight and repeated cauterizations until they are entirely removed.

Multiple fibromas, adenomas, osteomas (Leblanc), *neuromas* and the other neoplastic species are more rare. If they are numerous, interference is difficult and often useless. When they are isolated the treatment consists in the free removal of the neoplasia. The adenoma of Lièvaux was not adherent to the skin: its extirpation was easy. Bony plates of the subcutaneous connective tissue (Liard, Laquerrière) are removed almost always successfully.

Epitheliomas and *cancroids* are ordinarily met in the neighborhood of natural openings, most commonly the lips. They are peculiarly common on old dogs. Their clinical characteristics are well known: at first a small, hard, invading tumor; later, painless or almost painless ulceration, sharply outlined at the top, dry at the base, grayish in color, surrounded with indurations and accompanied with specific lymphangitis and adenitis. At the beginning recovery has sometimes been obtained with arsenical caustics. Chlorate of potassium in powder or saturated solution and methylene blue have succeeded in some cases. But total extirpation of the neoplastic center is still the chosen treatment. It is important to operate early, before the appearance of the adenopathies. (See *Treatment of Tumors in General.*)

Cutaneous and *hypodermic sarcomas* exist ordinarily with visceral growths of the same nature, more or less generalized.

PARASITIC AFFECTIONS.

We shall say nothing of the affections produced by insects, acari or fungi which live on the surface of the skin. The genera *sarcophagus* and *lucilla* give larvæ which live as parasites upon wounds of men and of animals; Megnin has found on them the *sarcophagus magnificent.* In Holland the developed larvæ of lucilla have been observed on sheep. In tropical countries the larvæ of some meat-flies deposited on the umbilicus of young calves produce fatal inflammations (Friedberger and Fröhner). Cleanliness and washing with antiseptic solutions are sufficient to perfect a cure. The *ochromycis anthropophagus*, or fly of Cayor, gives larvæ which develop in the subcutaneous connective tissue of man and some animals (dogs, cats, goats). The small tumors that they produce disappear rapidly after the exit of the larvæ, which can be assisted by a free incision. The connective tissue of pigeons contains sometimes a larvæ (*hypodectes columbarum*) which produces slight inflammation.

During the summer season the *hypoderma bovis* lays eggs on the surface of the skin of cattle, which produce larvæ that perforate the skin and develop in the subcutaneous tissue. In the following spring tumors in various numbers are observed on the body of the animal, about the size of a nut and resembling cold abscesses. These are due to the chronic inflammation caused by the presence of the parasites. The skin ulcerates and presents little suppurating wounds. The trouble can be prevented by soaking the skin in appropriate solutions (oak-leaf decoctions, weak solutions of tobacco, aloes, asafetida). It has been recommended not to take the animal to pasture before ten o'clock in the morning during the warm season (from April to August). The larvæ that are thrown out before that hour fall on the floor of the stable and die, while they would develop easily in pastures. The larvæ can be killed in their pouch by injections of benzine, turpentine, salt water, tar, or they can be cauterized with a red-hot stylet; but the best treatment is to freely incise them, taking hold of the larvæ with forceps or extracting them by pressure. Simple cleanliness is sufficient to insure recovery.

The subcutaneous tissue of horses and donkeys gives asylum to larvæ which resemble much those of the *hypoderma bovis.* These demand the same preventive and curative treatment.

Filaria may produce in some animals cutaneous helminthiasis. Horses of Oriental breeds are subject to a special affection characterized by the eruption of "hemorrhagic pimples." During the warm season one may observe in numerous regions, especially the withers, neck, back and loins, pimples in various numbers and sizes, from that of a hazel-nut to a large nut. First œdematous on their periphery, slightly ecchymotic in the

center, they soon ulcerate and give escape to blood which sticks to the hair; these hemorrhages are produced by filaria, whose last habitat was the subcutaneous connective tissue (*filaria multipapillosa* or *hæmorrhagica*). Successive eruptions are observed during the warm season; the disease generally disappears with the cold weather, but it may return the following year. Though Brunswig and Liautard have seen animals die from anæmia following these hemorrhages, death is the exception. The rapid cicatrization of the ulcerated pimple is the rule; sometimes suppuration occurs (Lamy). That which renders the affection serious is the impossibility of using the animals, some remaining unfit to work for months notwithstanding all forms of treatment (Drouilly).

The therapeutics is simple. Sustain the patients on good food, and do not use them when the presence of the pimples interferes with the wearing of harness. Wash the wounds with antiseptic solutions. When there is suppuration Lamy cauterizes with the hot iron. If the pimple is observed at the moment of the spontaneous opening the filaria can be extracted and its entrance in the cellular tissue prevented.

The larvæ of the *filaria irritans* are often the cause of serious complications of wounds. (See *Summer Wounds.*)

We may also mention as a parasitic disease of the skin "a cutaneous affection which often attacks hens, turkeys, especially pigeons, and sometimes geese (Csokor), and to which the name has been given of cutaneous psorospermosis, *epithelioma contagiosum* or *molluscum contagiosum.*" It is characterized by the production of nodosities, warts on the head, which can, however, in pigeons cover the whole body.

Cauterization or ablation of the tumors is the most efficacious treatment. Disinfection and isolation are to be recommended.

The connective tissue sometimes lodges psorosperms (*balbianeal gigantes*). Met with in cattle, sheep, goats or swine, they do not seem to produce any trouble and offer no interest from a surgical point of view.

Hydatic cysts give rise sometimes to external growths in the cellular tissue. Raymond treated a horse which had a tumor on the costal region which healed after seven years, having thrown out a large number of echinococci. Villate, Colin, Broquet and Megnin have reported similar cases, always in horses. These hydatic cysts at times undergo purulent transformation. In an abscess of the temporal fossa Kirkman found a handful of hydatids. At the post-mortem examination of a horse killed on account of its bad condition, Ranvier and Dehors found a large abscess extending from the left kidney to the superior border of the ilium; the pus contained a hundred or more echinococci. Simple incision and puncture followed by iodine injection are insufficient in the treatment

of hydatic cysts. Total extirpation is the best way. When impracticable, remove all that can be taken off, use the curette on the rest.

Rivolta, Bassi, Gotti, Perroncito, and Vigezzi have described, in the case of horses, donkeys and dogs, fibrous tumors of the connective tissue due to *spiropterus reticulus*. They are frequent on the anterior leg, at times compress tendons or nerves and give rise to lameness. Tschulowski has shown that among horses which are the carriers of the *spiropterus reticulus* the embryos are ordinarily found in lymphatic vessels, the perivascular connective tissue and the articular and tendinous synovial membranes of the extremities. (See Raillet, *Traité de Zoologie médicale;* and Neumann, *Treatise on Parasitic Affections of Domestic Animals.*)

The extirpation of the tumors is the only proper treatment.

CHAPTER II.

SEROUS BURSÆ.

I.

TRAUMATIC LESIONS.

Wounds of serous bursæ do not essentially differ from those of the cellular tissue, except by the flow of a fluid of synovial aspect, which might make one fancy an articular lesion. The clinical characteristics combined with the anatomical data allow one in all cases to recognize the nature of the disease. The gravity of the trauma depends on its extent, its aseptic or infectious character, and the properties of the pathogenous agents deposited in it.

The treatment must be antiseptic: clipping of the hair around it, irrigation with a strong disinfecting solution, in some cases sutures and a closing dressing. If inflammatory manifestations occur, free opening and treatment of abscesses are required.

Bruises of serous bursæ have a varied progress. A violent blow may rupture their walls and bring on the escape of the fluid they contain into the surrounding connective tissue. Sometimes extravasation of blood takes place in the cavity of the bursæ, or an acute hygroma is formed.

These accidents should be treated first with cool applications and afterwards with moist heat and pressure. Blisters, firing, puncture, free incisions with asepsis are the means recommended for obstinate hematomas. Suppuration demands an early opening.

II.

HYGROMAS—BURSITIS.

The ordinary causes of inflammation of serous bursæ are violent or repeated traumatisms, inflammation of surrounding parts (phlegmon, lymphangitis, arthritis) and certain general morbid conditions (rheumatism, strangles, purulent infection). In the great majority of cases hygromas are due to mechanical causes: the action of the heel of the shoe pressing on the elbow when the animal lies down, the pressure and the rubbing of parts of the harness on the withers or the poll of the head.

According to the intensity of the local phenomena hygromas are *acute* or *chronic*. In *acute hygromas* the tumor is warm, painful, œdematous or fluctuating. The contents vary with the acuteness of the inflammation: although generally serous and mixed with fibrinous clots, it may be hemorrhagic or purulent.

The therapeutics consist in reducing the inflammatory symptoms and preventing suppuration. If the tumor is recent it may disappear by the simple removal of the cause. Refrigeration at the beginning and later balneation or tepid antiseptic lotions are the best means to use. If rheumatismal diathesis is suspected salicylate of soda is to be prescribed. With such treatment suppuration is prevented and either resolution takes place or the hygroma becomes chronic. When suppuration occurs, free or counter-openings should be made to allow the escape of the pus. Antiseptic irrigations followed by the application of a dressing or of absorbing powders complete the treatment. Sometimes there remains a fistula of difficult cicatrization.

Chronic hygromas are commonly seen in horses and in cattle, with which they are accidents of daily occurrence: the elbow, poll, withers and point of the hock furnish frequent examples of them. Sometimes they follow acute hygromas; at others they gradually develop under the influence of slight but continued irritation. Their wall, first soft, becomes indurated or even calcareous. Sometimes they have but one cavity, at others they have several distinct or communicating chambers. Their internal wall is smooth at the beginning; later it sometimes has false membranes or vegetations (proliferans hygroma). These membranes, which are loose, form small foreign bodies called riziform[1] grains. The contents of chronic hygroma is a viscous, clear or hematic serosity, with, perhaps, fibrinous clots or calcareous concretions.

The walls of the pouch may indurate (*fibrous hygroma*) and form almost the entirety of the growth; then there is scarcely a small cavity full of fluid, in the center of the mass. In cattle, some hygromas reach enormous proportions and are covered with large horny growths.

In the treatment of chronic hygromas, one must, before everything else, remove the cause of the trouble: to remove the frictions and the rubbings that keep up the irritation is an indispensable condition. Curative means vary with the age of the lesion. If the inflammatory symptoms are quite severe, if there is lameness, rest is to be prescribed. At the outset, astringent lotions, the traditional mixture of vinegar and common chalk, may prove sufficient. Delwart has recommended the mixture of clay, vinegar, and sulphate of iron. Weber advises the following mixture:

[1] Rice-formed.

	Grams.
Norway tar	450
Green-soap	450
Tannin powder	100

"Every day, after stirring the mixture, a simple painting with a brush is made without friction. This application is renewed every day without taking notice of what takes place or being frightened at the sloughing of large epidermic patches, which come off after several days of treatment, and which must take place without interruption until recovery. No accident is to be feared, for no serious consequence and no scars have ever followed."

Irritating frictions (turpentine, ammonia, spirits of lavender) or blisters (charges) ordinarily fail. Straight-line or needle firing is more efficacious; some obstinate hygromas are relieved by cauterization, when the cause of the trouble has also been removed.

The *crushing* of the pouch, which is possible when the walls are thin, is not sufficient: the exudation returns.

Aseptic puncture with trocar or bistoury does not succeed better; it permits the escape of the contents of the tumor, but the wound cicatrizes rapidly; the internal unmodified membrane continues to secrete and the fluid collection returns. The puncture must be completed by an irritating injection. Solutions of iodine succeed well in the treatment of hygromas with thin walls. The *modus operandi* is described in the chapter on *Tendinous Hygromas*. No serious complications need be looked for. Other agents than iodine may be used: carbolic acid, 3–5 per cent.; corrosive sublimate, 1 in 1000 or 500; thymic acid and a mixture of ergotine and muriate of morphine give similar results. It is good, if possible, to add *pressure* after the *injection* by a wadded dressing, or better, an elastic bandage. The last is advised for the knee and fetlock to insure and accelerate recovery.

Drainage is sometimes used successfully against some hygromas. Ordinarily a seton, tape, or long tent of oakum is passed through the vertical axis of the tumor. This means, which brings on recovery by the suppuration of the pouch, is objectionable, since it leaves two cicatrices; and if the ends of the seton are tied up, it allows the possible tearing of the skin. It is better to have recourse to a drainage-tube fixed by a stitch of suture or a safety-pin. Dependent puncture, fixation of a short drain and irritating injections constitute a good treatment.

Subcutaneous discission is a delicate operation, too commonly followed by a return of the trouble to be recommended. Ordinary *incision* is preferable. After disinfection of the surfaces the pouch is freely opened, the fluid allowed to escape, the clots removed, the rice-formed masses extrac-

ted if there are any, and the vegetations or more or less calcareous pseudo-serous membranes are scraped off with the sharp curette. By using corrosive sublimate or carbolic acid, the radical operation is without danger. Curettage of the internal membrane is to be preferred to cauterization, actual or potential. The operation is completed by a few stitches of suture, an iodoform dressing if possible, or collodion and antiseptic powders.

Sometimes the walls, fibrous or calcareous, have considerable thickness. In such a case extirpation may be attempted. If the tumor is pedunculated, elastic ligature is the best; if the base is wide, a sharp instrument is to be used: incise the skin, enucleate the mass without opening it, or divide in two and remove each half separately. Well-applied hemostasis, sutures, and disinfection afterwards may permit the rapid union of the edges without suppuration. This is the ordinary treatment of old capped elbows rebel to injections and cauterization.

Before considering hygromas individually, we will mention, once for all, the *serous collections* that may be found in the various species, particularly cattle, on the projecting parts of the body, especially the trochanter, external angle of the ilium, point of the ischium and external face of the thigh. Their treatment is that of recent hygromas, a similar one to that of traumatic serous effusions. We especially recommend dependent puncture, drainage and injections of strong antiseptic solutions.

SPECIAL HYGROMAS.

I. Hygroma of the Elbow—Capped Elbow.

The repeated pressure of the heels of the shoe upon the summit of the cubitus, in horses that lie down cow-fashion, produce, on the skin and subcutaneous tissues, lesions of various kinds which are classed under the general name of capped elbow. If the lesion consists in a dropsical condition of the serous bursa of the elbow, in a true *hygroma* it is produced in some cases by an acute or chronic inflammation of the skin or of the cellular tissue underneath. According to the nature of the alterations, capped elbows are *œdematous*, *cystic*, *phlegmonous* and *indurated*. They are also divided into *old* and *recent*, *acute* and *chronic*.

In the sterno-costal decubitus, the body is supported by the sternum, the abdomen and a little of one side of the thorax, it being always slightly inclined to the right or to the left. The canon and the phalanges, flexed upon the knee, come to lie against the forearm, and as the length of these two folded parts is apparently the same, the heels of the shoe can press upon the elbow. On many animals this is harmless. If the animal lies on its right side, for instance, the right foot comes and rests between the chest and the elbow on the coresponding axilla; the left is carried suf-

ciently in abduction to have no connection with the olecranon. It seems that a special conformation of the knee, reducing abduction, must be necessary to bring on this contact with the elbow. Perhaps, also, as Bouley says, the relative lengths of the forearm and canon have an influence upon the relations of those parts. What is certain is, that most of the horses lie cow-fashion, and that capped elbow occurs only on predisposed animals.

Fig. 57.—Shoe-Boil.

The best way to prevent it would be to tie up the animal short enough to prevent its lying down; but this could not be done long. Sometimes by placing the animal in a box-stall or tying it sufficiently long so that it will not assume the sterno-costal, but the lateral decubitus, young animals may be taught by punishment not to assume this position. Often the capped elbow is produced by a shoe which is too long; shortening the branches, especially the internal, beveling them, and indenting them in the hoof may prevent the trouble and cure recent lesions. The crescent shoe is advantageous. (Fig. 57.)

A well-shod horse whose hoof only rests on the olecranon may nevertheless become affected with hygromas. The contact then must be relieved by applications on the foot of pads, bags of bran or india-rubber air-cushions (Bouley). A thick roll applied above the knee on the canon, the coronet or the heels may do well: during the flexion of the leg it presses against the thorax and forces abduction; it also keeps the metatarsal and the forearm apart. Zundel advises placing on the back of the knee in the direction of the leg a stiff roll of straw secured above and below on the lower part of the forearm and the superior portion of the

canon; this will prevent the flexion of the anterior affected leg. Placing sharp points or using pads with sharp nails is a dangerous thing to do. A good shoeing and simple soft pads are generally sufficient. A muzzle is sometimes used to prevent the animal biting its elbow.

Local therapeutic means can be advantageous only when the region is relieved of the bruising action of the shoe or of the heel of the foot. The capped elbow when recent is soft and œdematous. Douches, slight massage, astringent applications (white lotion, vinegar and chalk) and exercise are sufficient to obtain the absorption of the exudation from the subcutaneous connective tissue. If the result is incomplete Lebas charges or blisters can be used.

The cystic capped elbow, the true hygroma of the elbow, ordinarily does not yield to these means of treatment. Repeated blistering applications have been prescribed for it, especially the bi-iodide of mercury. The preparation of Weber spoken of above applied daily will, after three or four weeks, remove some voluminous hygromas of the elbow. Mr. Weber says that this treatment "has never failed with him." Several veterinarians have also obtained excellent results from its use. Puncture is efficacious only when it is completed by the destruction of the cystic membrane. The puncture should be made with the red-hot iron, the internal face of the wall should be scorched with it or touched with a caustic substance (tincture of iodine, solutions of potash, chloride of zinc). Sometimes after the opening a blister or a few points of firing are put on the surface of the tumor. Some practitioners still use the vertical seton. When the capped elbow is the seat of an active inflammation this can be relieved by cold applications, emollients or camphorated ointment. Vesicating agents to promote suppuration are also used. When the abscess is formed a free opening is made, followed by frequent injections.

A more energetic treatment is necessary with *indurated capped* elbow. Blisters and mercurial frictions have little effect: the Weber preparation finds obstinate cases and cauterization does not always succeed. After trying all these, if the tumor is quite circumscribed it must be extirpated. The ecraseur crushes the tissues and leaves a bruised zone which sloughs off by suppuration and retards cicatrization. Elastic ligature is always to be preferred when the tumor is somewhat pedunculated. When it is wide and the application of the ligature somewhat difficult, Möller recommends the use first of a very fine india-rubber thread, which will not slip so easily. After a few days, when the tumor has swollen by hyperæmia and exudation, this thread should be replaced by another coarser. The elastic ligature can, however, be kept in position with the aid of a metallic pin pushed through the mass (a kind of pin suture). The section of the neoplasm will take from five to ten

days, according to its size. It is better to have the amputation performed entirely by the ligature than to finish it with the bistoury: the wound heals quickly and leaves but a little cicatrix.[1]

Excision is frequently made with the bistoury, but it is often more difficult than at first thought, and often leaves a large wound. The animal having been thrown on the opposite side and the diseased leg carried forward, the region is shaved and disinfected. Two curved incisions meeting at their extremities are made on each side of the central axis of the tumor, circumscribing a flap of skin, which is removed with the mass. By careful dissection, avoiding injuries to the muscles, the antibrachial aponeurosis or the head of the olecranon, the fibrous neoplasm is removed; the edges of the wound are then brought together with silk or silkworm-gut, and the whole is covered with a collodion plaster or a dressing.

By paying attention to antisepsis union by first intention may be obtained, though it is not to be greatly expected in ordinary practice. The patient should remain at rest from one to three weeks. In the first days following the operation the animal should not be permitted to lie down.

To resume, when the cause is removed recent capped elbows, œdematous or cystic, should be treated with antiphlogistics, astringents, the Weber preparation or blisters. Phlegmonous growths demand the same treatment as abscesses. Being indurated neoplasms, they ordinarily require the use of ligature or of the bistoury.

Once cured, the return of the trouble is prevented by following the regulations given above.

Large-sized dogs which have the habit of lying in a sternal position, with the elbows resting on the ground, are exposed to callosities of the skin of that region and inflammation of the olecranal bursa. When this enlarges it forms a rounded or ovoid tumor, fluctuating and sometimes accompanied with inflammatory manifestations. In some cases the surrounding tissues become indurated.

Whatever has been the growth of the tumor, and whether its contents be serous or sero-fibrinous, recovery is not easy to obtain. Puncture is insufficient and ligatures hold badly. The removal of the sac is the preferable method, performed aseptically without exposing the bone and then dressed with a wadded dressing.

[1] Our experience with the use of the elastic ligature for the removal of these tumors justifies us in differing from the author in his conclusions. With us and many American veterinarians the wound has always been very slow in repairing and the cicatrix has been rather ugly. With Myers one case lasted from January to May before entirely healed. (Amer. Vet. Review, vol. xi., p. 121.)

II. Hygroma of the Knee.

This hygroma that Percivall calls "capped knee," is not rare in horses. It is observed principally in those that rise "cow-fashion," and on those that have fallen on their knees without division of the skin. It is frequent in cattle. Its frequency depends on the way in which animals lie down and rise. Some remain a certain time on their knees; the pressure and rubbing on that region wear the hair, irritate the skin, lacerate the connective tissue or give rise to a serous exudation. Serres condemned the bad condition of many barn-floors in southern France, and also the habit of having no bedding except for the hind quarters.

Fig. 58.—Hygroma of the Knee.

In horses, recent precarpal hygroma is generally painless, diffuse, spread over the anterior face of the knee (Fig. 58) and evenly fluctuating. Whatever its size may be those characteristics are sufficient to distinguish it clearly from the tumors formed by the dropsy of the tendinous or articular synovial sacs of that region. In time the walls thicken and become indurated here and there; in its cavity floating bodies ("riziform") can be detected; sometimes inflammation occurs and purulent transformation follows. In cattle, the growth may reach considerable dimensions (Fig. 59). Sometimes the skin is excoriated more or less deeply; not uncommonly is it indurated, partly ossified and covered with a thick horny production (Fig. 60).

If the build of the barns is defective let it be remedied. When the tumor is recent and small, irritating frictions (turpentine and ammonia mixed, tincture of cantharides, camphorated alcohol) or blisters are recommended. These sometimes succeed when the sero-bloody collection of the connective tissue is small; when it is abundant they fail. Puncture with the trocar is insufficient; it must be completed with iodine injections. Moderate pressure with the dressing or the elastic band assists in the recovery.

Freely open the pouch on its dependent side, remove the fibrinous clots and rice-formed bodies that may be there, place a drain, and twice a day inject carbolic-acid water or weak tincture of iodine: such treatment will give the best results.

The *seton* run vertically is used by many; the cavity closes by granulation. A tent of flax or an india-rubber drainage-tube in place, an-

tiseptic injections can be thrown into the cavity. This treatment is followed by induration of the knee. Furlanetto, with the seton, applies a blister or a compressive figure 8 bandage over the knee.

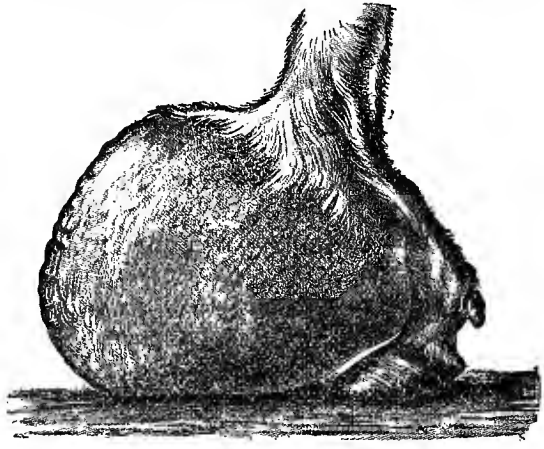


Fig. 59.—Hygroma of the Knee in a cow (from Stockfleth). The tumor measured 1 m. 56 in. in circumference. It was of one year's standing. It interfered with locomotion. When the foot rested on the ground it flattened down on its inferior surface.

Needle cauterization has given good results in the case of horses.

Fig. 60.—Hygroma of the Knee partly ossified and covered with a horny growth (from Stockfleth).

When the hygroma is indurated, deep firing, excision or extirpation are necessary. In cattle, Saussol divided the tumor vertically with the bistoury, almost entirely removed the yellow lardaceous mass which forms it, and cauterized it with the hot iron; after a month the recovery was almost complete, but an ugly cicatrix was left. Serres made, on the most projecting portion of the tumor, two convergent curved incisions, bounding an elliptic flap of skin, which was excised with the tumor. The whole of this was then removed as thoroughly as possible, and a quilled suture dressing applied.

With antisepsis more favorable results can be obtained. The technic

used to remove the cicatrices of broken knees is here applicable. The synovial membranes should be avoided, solid suture be applied and the region immobilized with a plaster splint.

Horny productions on the anterior face of the knees of cattle must be extirpated. Interference is obviously limited to cases where the growth is not too large and its surface of implantation not too wide.

III. Hygroma of the Stifle.

Prepatellar hygroma must be distinguished from the femoro-tibio-patellar hydrarthrosis. In some cases the diagnosis is difficult, and both may exist together. This hygroma deforms the part, but produces no lameness and does not incommode the patient.

Puncture with the trocar, iodine injections, line or point firing, dependent puncture with the bistoury, and drainage with antiseptic injections are the means used when the diagnosis is established.[1]

Once open, suppuration may last for a long time. It must be treated with strong antiseptic or slightly caustic solutions.

IV. Hygroma of the Hock—Capped Hock.

The point of the hock is not infrequently the seat of an œdematous, phlegmonous or indurated tumefaction, called by old hippiaters "capped hock." It starts in inflammation of the subcutaneous serous bursæ or of the connective layer which unites the skin to the tendon of the deep flexor of the phalanges. External blows, kicks, rubbing against the stalls or other hard bodies are the causes of this affection. It has sometimes manifested itself after anasarca, excessive or premature work, slips or violent efforts (Peuch). It has been observed on both legs without evident cause (Furlanetto). Often its growth is so rapid that in one night it may become as big as a small orange. In the beginning it is often warm and painful; its resolution can then be easily obtained. (Fig. 61.)

To pad the sides of the stall and prevent the animal from rubbing its hocks, and from kicking by having the hind legs hobbled together, are the first precautions to be taken. The local treatment consists in douches and astringent applications—vinegar and common chalk, a mixture of clay, vinegar and sulphate of iron (Delwart). If irritations are kept up

[1] The size that this form of hygroma assumes is sometimes enormous. We had an opportunity to observe one case where it was so large that locomotion was entirely impossible. We tapped it four days in succession, removing on the first day fifty-two ounces of fluid; on the second, over twenty-six; on the third, six, and on the fourth puncture, four ounces were again removed. In this case suppuration was comparatively small on account of the free use of tincture of iodine irrigations which were used. (*A. Liautard:* Lameness of Horses, page 153. 1888.)

on the parts, the tumor begins to increase in size, to indurate and to assume a character of chronicity which renders recovery very difficult. All kinds of vesicating agents have been tried (blisters of cantharides and of mercurial preparations, etc.). The best results have been obtained by repeated applications of preparations of moderate activity. In these seems to be the secret of success. Thus can be explained the results obtained with the Weber preparation, which has shown itself most efficacious in numerous old voluminous capped hocks. Rest is not necessary; on the contrary, work is advantageous during the treatment.

Fig. 61.—Capped Hock.

Penetrating point firing has its patrons; we have used it with success, but it is slow, not to be depended upon, and leaves scars. Puncture is insufficient. *Iodine injections* have given recoveries to Leblanc, Cambron, Verrier, Liard, and many others. Leblanc's case was the size of the fist, of long date, and had resisted many forms of treatment. The animal was very nervous and had to be thrown to receive the injection (1 per cent. tincture iodine, 2 per cent. of water). After fifteen days, the liquid collection having returned, a second injection was made. Recovery was complete. The mare treated by Cambron had a capped hock as big as a child's head; puncture gave escape to one and a half liters of fluid. A first injection being followed only by improvement, a second was made, and the tumor disappeared entirely. Verrier injected two voluminous capped hocks on the same horse; he saw the animal three months afterwards entirely recovered. A horse treated by Liard (obs. 6) was also cured by one injection: after three months the growth was reduced three-quarters of its size, and ultimately disappeared. Another horse (obs. 5), after the injection, rubbed its hock against the stall, the sac opened, suppurated and filled with granulations; later the tumor subsided, but the point of the hock carried a cicatrix.

Free *incision* made without asepsis exposes the lesion to severe complications: at times it becomes a suppurative phlegmasia of long duration, or the growth indurates and considerably increases. Even when made antiseptically and completed with a wadded dressing, the operation does not seem to have given such brilliant results. Besides, it requires a long rest.

Heil says he has cured some capped hocks by rupture obtained as follows: While the sound hind leg is flexed and held up by an assistant, a ligature sufficiently tight to be inconvenient to the horse is put on the diseased leg above the hock; the leg that was raised is let go; the animal makes violent efforts to free itself from the ligature; the hygroma bursts; its contents spread into the surrounding connective tissue and are absorbed. The trouble will not return.

The same treatment cannot be applied to all capped hocks. In general, if the lesion is recent, douches, cold baths, astringents, massage and tannic liniment are to be prescribed. If the tumor is older, but of moderate size, it should still be treated with liniment or light blisters; if it is larger, and has still preserved the character of a cyst, actual cauterization or an iodine injection may be selected. With indurated capped hocks of large size, needle firing and also tannic liniment should be used. If the growth becomes phlegmonous, it should be opened and the cavity washed out with antiseptics.

V. Hygroma of the Fetlock.

Most authors describe under the name of *hygroma of the fetlock* the distension of the synovial sheath that assists the sliding of the anterior extensor of the phalanges upon the anterior face of that region. Thus formed, the tumor is ordinarily soft, fluctuating, painless, and well bilobed when it is large. We will study it in the chapter on *Tendinous Synovial Dropsies*. The true hygroma of the fetlock, like that of the knee, is subcutaneous, developed between the skin and tendon. Diffused, spread, and sometimes œdematous at the start, it becomes circumscribed and indurated with time, but rarely becomes very large. Its treatment differs little from that of benign forms of hygromas of the knee. Recent tumors generally yield to pressure, massage or light absorbents. Old hygromas demand puncture with irritating injections, cauterization or incision.

VI. Hygroma of the Canon.

This is always localized on the internal face of that region, is due to blows from the inner side of the shoe or corresponding quarter of the foot of animals with irregular gaits, and sometimes it accidentally comes to horses with sound standing and normal action.

Its characters differ. Sometimes it is chronic, and appears under the aspect of a soft, elastic tumor, well-defined and without manifest inflammatory phenomena: such a one would be treated with puncture and iodine injections or with deep penetrating point firing. Acute and phlegmonous, it forms a warm, painful tumor, extending more or less on the canon; with its surroundings indurated and its center fluctuating, the only

thing to do is to puncture it on the most dependent part. Antiseptic care easily brings recovery. If there is undermining of the skin, puncture is not enough, because the wound would close too rapidly; a drainage-tube is necessary to permit the escape of pus and the injections of antiseptic washes. Seton is less recommendable.

Hygroma of the Withers. (See *Diseases of the Withers*, vol. 2.)

Hygroma of the Poll. (See *Diseases of the Poll*, vol. 2.)

III.

NEOPLASMS.

Tumors of serous bursæ are exceptionally rare. The walls of these cavities may, however, be the starting-point for neoplasms of various kinds: sarcomas, fibromas, myxomas, fibrochondromas and epitheliomas. Fibromas and sarcomas are most ordinarily observed.

The characters vary with the nature of the lesions. The clinical diagnosis is somewhat difficult, since the marked induration of many chronic hygromas may resemble a true neoplasm.

With malignant tumors, early and complete extirpation is here, as in similar cases, the only efficacious treatment. Such is it also for benignant growths which produce functional disturbances. Cauterization is to be used only in cases of induration of an inflammatory nature produced by chronic hygromas.

CHAPTER III.

MUSCLES.

I.

TRAUMATIC LESIONS.

Bruises (*contusions*) of *muscles* have external causes (traumas) and internal causes (fractures, luxations). They vary from the slightest excitement (*muscular stupor*) to complete rupture or crushing. The more elastic skin yields without breaking, while the muscle underneath is cleanly divided or bruised. Commonly, the alterations consist in fibrillar ruptures with bloody infiltration or only in a partial division: hemorrhage takes place, the cavity is filled, and a hematoma is formed.

Rest, douches in some cases, wadded paddings, are the treatment useful in the beginning. Even when there is partial or total rupture, the therapeutic is not yet very active. (See *Ruptures.*) Later, massage is to be employed. When a sero-bloody collection remains, it is necessary to have recourse to puncture followed by an alterative injection, methodical pressure or incision. (See *Contusions.*) If the traumatic center suppurates, free openings and antiseptic irrigations are necessary. In cattle, bruises of the gastrocnemius are often accompanied with suppuration. Puncture and carbolic injections insure recovery. (Stockfleth.)

Pricks with aseptic instruments heal promptly. If they are infected, they are accompanied with severe phlegmasic phenomena and suppuration, and must be treated according to the rules indicated in the chapter on *Pricks* in general.

Wounds with sharp instruments affect the muscle more or less deeply and in various directions. If they are parallel to its axis, they have no tendency to open widely; there is but a slight slit, which will close rapidly. If, on the contrary, the organ is divided transversely, there is first an abundant hemorrhage, both ends separate, and the wound gapes. Whatever may be its extent or its character, it must be carefully disinfected, especially if the injuring body is dirty; and the leg must be put into the best position to favor the closing together of the ends of the muscle. This is sometimes difficult to realize. The leg should be kept extended with an unremovable bandage in cases of the section of an extensor, and flexed if there is section of a flexor: attempts may be made to bring

both divided ends together by sutures; but generally they are cut by the threads. Complications must be guarded against; dressings must be applied on the legs; on the trunk, ordinarily one is satisfied with washings and the use of absorbing powders. In most cases a thick fibrous layer is formed between the two muscular stumps; the muscle becomes digastric. One must also watch the progress of the repairing phenomena; it is possible that the cicatricial tissue will contract adherences with the surrounding bone, thus destroying the action of the muscle; though ordinarily these fibrous adhesions break up and the leg returns to its normal function.

In all animals, *contused wounds* are the most common and also the most serious. They expose them to all the complications of extensive traumatisms. The bloody exudation, the laceration of injured parts, and the abundant connective tissue interposed between the various muscular layers are so many conditions which promote suppuration and the migration of pus into more or less distant regions. In the observation of Rigollat, the great scapulo-humeral muscle had been entirely divided by a kick at its insertion in the humerus; there was a wound twelve centimeters long, five wide and four deep. *Balls* that pierce through a muscle make a canaliculate loss of substance. If the wound has been made during contraction of the muscle, when it relaxes the tract does not correspond any more to the cutaneous and aponeurotic openings, and if suppuration occurs, it accumulates in the tract. The wound should be carefully disinfected in every part (irrigation, antiseptic bath), and, if possible, it should be protected with a dressing. The wounds of the trunk should be irrigated two or three times a day with disinfecting fluids, then covered with antiseptic or simply absorbing powders. In the traumatisms of the croup or of the thigh, subcrustaceous cicatrization is obtained easily: the wound having been disinfected, and then dusted with tannin, coal-tar, or charcoal, covers itself with a scab, under which cicatrization goes on without abundant suppuration. In wounds made with substances soiled by earth, septicæmia and tetanus are particularly to be feared. If the pus filtrates between muscular layers, counter-openings should be made. Drains will permit the thorough cleansing of the wounds. The therapeutics of *tearings* does not differ from that of contused wounds.

II.

RUPTURES.

Solutions of continuity of muscles by their contraction are the ones which truly deserve the name of ruptures. When traumatic, they belong to the chapter on *Contusions*.

Muscular tears have been especially observed in horses; they are not so

common in cattle or dogs, but are seen in swine (Ostertag) and birds (Larcher) frequently. *Complete rupture* of muscles is much less common than that of tendons or of bones; when it occurs, it is either the fleshy part which is affected or, as is more commonly the case, the musculo-tendinous portion. *Incomplete* ruptures involving only a few fibres are facts of daily occurrence: the partial ruptures of the *ilio-spinalis* muscle in horses secured in a recumbent position are frequently observed. (See *Myositis.*)

Lesions of degeneration of muscular fibres promote ruptures. In man, these degenerations have been observed in typhoid fever, smallpox and other infectious diseases; they are also observed in animals during analogous affections. Rupture may sometimes occur in muscles absolutely sound, under the influence of a violent contraction. Muscles in condition of activity have an enormous resisting power. Experiments have shown that in dogs the biceps is ten times more resisting during life than after death; from this some have concluded that rupture was impossible during the state of contraction for them. Antagonistics are those which would bring on distension and rupture of the relaxed muscle; but inco-ordinated contraction may overcome the resistance of the muscular fibre, and it is thus that the great majority of ruptures take place.

In colts and in calves, sometimes, during the few hours following birth, one observes pseudo-paralysis of one or several members, due to muscular ruptures. On a two-day-old colt which was unable to stand up, and was killed, Knoll found the anterior extensor of the phalanges ruptured on the right anterior leg. Sussdorf has reported a similar case. Whether the accident is the result of powerful contraction of the muscles, as Sussdorf believes, or of dystokial difficulty, it is always serious, and treatment ought not to be undertaken except on animals of great value.

In adults, muscular ruptures are observed especially after violent efforts, falls, slips or blows. Partial ruptures involve the superficial or the deep part of the organ; long muscles are more exposed than the others; thin, flat muscles, those that are not surrounded by a restraining aponeurosis, rupture most commonly in their superficial layers; the muscles that have a thick sheath rupture rather towards the center (Rigot). As the fibres do not give way on the same level, the surface of the fracture is always irregular and ragged. An exudation of blood fills the space left between the divided ends.

Ruptures of the following muscles have been recorded: *Pectoral, mastoido-humeralis, subscapularis, coraco-radialis, extensors of the fore-arm, ilio-spinalis, anterior crural muscles, bifemoro-calcaneal, tibio-premetatarsal,* and *diaphragm.* The observations 2, 3 and 4 of the report of Rigot relate to the rupture of the *subscapularis* muscle. Tearings of the *coraco-radialis* are at times partial and again complete. Goubaux has

reported two observations of rupture of this muscle: in a twelve-year-old horse destroyed for dissection, he found on both legs a cicatrized rupture of the long flexor of the forearm; in a seven-year patient which was very lame in the left fore leg, he found in that muscle five cystic pouches, evidences of previous ruptures, and also the cicatrix of a complete rupture of its inferior tendon. Nesbit has made the post-mortem examination of a horse in which on both legs the coraco-radialis muscle was torn from its scapular attachments.[1] Peuch records the following interesting observation: A horse running away struck against the angle of a wall, fell down and had some difficulty in getting up. On examination, he found that "a little below the right scapulo-humeral articulation, in the middle part of the long flexor of the forearm, there was an oblong tumor the size of the fist extending to the middle of the anterior brachial region; it was hot and painful." The animal rested only on its toe. The general symptoms were such that two days afterwards it was destroyed. At the autopsy, there was a diffused hemorrhagic center, a partial rupture of the mastoido-humeral muscle and on the bicipital groove a rupture of the width of two fingers; also a transverse solution of continuity of the coraco-radial muscle. At the autopsy of a horse that had hown symptoms of sprains of the loins, Rigot found the *great psoas* swollen, softened and partially torn. In tears of the *gluteal muscles*, of the superficial (long vastus) especially, the diseased leg is dropped, its bony supports half flexed; in walking, the step is shortened, the motion of the leg is limited, the toe drags on the ground; later there is a local simple depression, or a deformation of the region brought on by the atrophy of the muscle. The troubles of locomotion last sometimes for a long while. In a horse cast on the left side for castration, Raynand observed, on the right gluteal region, near the origin of the tail, a somewhat large swelling, though not very painful; in walking, the muscles of that region contracted with difficulty, the leg was dragged along and moved in abduction. The author made a diagnosis of *rupture of the long vastus and middle gluteus*. There remained a slight motion of abduction and a depression at the point of rupture. Partial ruptures and those of the *patellar* muscles are not rare. Delwart, Haubner, Schmidt, Hoffmann, and Bassi have recorded instances of them in horses; Hollmann and Meyer, in cows. Delwart says he has observed the laceration of the

[1] Professor Robertson has an animal destroyed because of severe osteo porosis. There was a great deformy, his body hanging between both fore legs, it the scapulæ having a horizontal position. At the post mortem it was found that on the right side the coracoid process had given way and on the left the tendon of the coraco radialis had ruptured about three-quarters of an inch from its attachment. (Amer. Vet. Review, vol. 21, p. 623.)

anterior straight muscle; but the reading of his case shows that the lesions he met had occurred during an attack of hemoglobinuria. At the post-mortem examination of a horse whose "entire muscular system" was discolored, Salle and Sergent found ruptures of the short adductor, of the thigh, and of the external ischio-tibial muscle.[1] [2] Krashe has recorded the case of a horse which was lame for a long while in one hind leg, and which one morning was found with it all deformed; the leg and thigh were much tumefied, the femur and tibia almost on a straight line, the hock much flexed on the tibia, to such an extent that at each step the point of the hock would touch the ground. Having been destroyed, at the post-mortem examination the gastrocnemius externus and internus were entirely torn at their superior attachment and extensively diseased with old degenerating myositis. A plate in Stockfleth's "Surgery" shows a cow whose hock almost touches the ground, and in which the gemini of the corresponding leg were found ruptured near their femoral insertion.[3] Some muscular ruptures are accompanied with some spinal diseases; that of the abdominal muscles ordinarily gives rise to hernia: that of the intercostals to pneumocele. In the observation of Jacotin, under the title of "Rupture of the Aponeurosis of the Great Serratus," as in that of Bouley of "Rupture of the Tendon of the Postea-Spinatus," it was a question of a paralysis of the sus-scapular nerve.

[1] Dr. Pendry has recorded the case of a trotting-horse which became lame and which by the peculiar history he suspected to be suffering with incomplete fracture of the femur. After a few days of treatment (slings and blister) the animal was found in the morning with a fracture of the lower extremity of the tibia. On making minute dissection of the leg and examining the condition of the ischio-tibial muscles he found a laceration of the anterior portion of the long vastus muscle, with large ante-mortem clots on its deep surface. (Amer. Vet. Review, vol. 8, p. 412.)

[2] Cases of rupture of the flexor metatarsi are recorded in the American Veterinary Review by Abele, in which recovery was quite rapid. After three weeks the lameness was hardly perceptible. (Vol. 20, p. 573.) In the observation of Lusk the horse walked quite sound after four weeks and resumed work a week later. (Vol. 21, p. 257.) A fatal case is also recorded from the clinic of a veterinary college in Chicago, in which at post mortem was found "an almost entire rupture of the tendinous portion of the flexor metatarsi with partial rupture of the muscular portion." The accident occurred while the horse was at work; he slipped on the ice, and on attempting to rise his near hind foot slipped back. (Vol. 22, p. 767.)

[3] Dr. Schreibler has reported a case of complete laceration of the gastrocnemius tendon in a greyhound, which was completely severed. The separate ends of the tendon were about one inch apart and the rupture about an inch and a half from the apex of the os calcis. The leg was placed in splints and left for about a month, when the dog was discharged. There remained much lameness, due to excessive atrophy of the muscles of the leg. (Amer. Vet. Review, vol. 9, p. 467.)

The *diagnosis* is sometimes difficult. Recent complete rupture is generally recognized by the swelling, the great abnormal sensibility of the region and the functional disturbances, which vary according to the muscles affected. Old, it is characterized by the presence of a notch or depression, or of two rounded stumps, with functional troubles. In young subjects and race-horses partial muscular ruptures are often the cause of temporary lameness and of irregularity of function whose diagnosis is difficult, and whose nature ordinarily remains undiscovered. Often the lameness has nothing peculiar and the local symptoms are little marked.

Partial muscular ruptures are repaired rapidly under the single influence of rest, and generally leave no locomotory trouble. In complete rupture sometimes a long fibrous piece or the separated cicatrization of both stumps interfere with the function of the muscle.

Even in the cases where positive diagnosis is made the therapeutics of muscular ruptures is poor. Absolute rest is imposed. In some cases unremovable apparatus may be used to bring the extremities of the muscles close together. If there is much pain, as in some cases, soothing preparations or frequent warm lotions should be applied. At the beginning the preparations which are generally recommended are of little advantage; later, when the cicatrization is partly made, stimulating frictions, massage, douches, vesicative agents, cauterizations and irritating injections are useful. If the hemorrhagic center suppurates, free incisions and frequent antiseptic irrigations are required. In a case reported by Anacker the rupture of the great psoas was followed by an abscess that opened in the abdomen and ended fatally. The suture of the muscular ends made aseptically and completed with a wadded dressing has been suggested, but in our animals in the ordinary conditions of practice it demands too much care and too many minutiæ.

III.

HERNIAS—LUXATIONS.

Muscular hernias, characterized by the protrusion of a greater or smaller portion of a muscle through a laceration of its investing aponeurosis, are little observed in animals. They have been seen only on the extremities, where they may occur through a solution of continuity in the fibrous sheaths which hold the fleshy parts close to the bones.

They are manifested by a varying enlargement of its size and shape, without heat or pain, and which increases in hardness with the contraction of the protruding organ. As in all similar accidents, the hernial part may become strangulated if the aponeurotic orifice is of very small size. Great pain and intense lameness indicate this complication. For simple

hernia compressible bandages to hold the organ in place are advisable until the cicatrization of the aponeurotic wound is complete. Strangulation demands the incision of the skin on the surface of the tumor and the exeresis of the protruding muscular part, with the closing of the borders of the aponeurosis and the suture of the skin.

With the exception of the displacement of the external ischio-tibial muscle, *muscular luxations* are very rare in veterinary medicine. Yet one can conceive that in peculiar circumstances long muscles might slip off the bony groove in which they slide and pass in front or behind it. The treatment would then be reduction, some restraining apparatus and rest.

We may mention here the case of *luxation of the brachial biceps* observed by Dominik in a horse that had run away.[1] It was manifested by very marked flexion of the arm upon the shoulder, very large tumefaction of the point of the shoulder, slight pain on exploration and dragging of the leg in walking. The animal was destroyed after three months.

LUXATION OF THE LONG VASTUS.

In cattle this muscle, which goes from the sacral spine to the superior extremity of the leg, glides over the trochanter by means of a large serous bursa. Its anterior border is intimately united to the aponeurosis of the *fascia lata*, which separates into two layers to embrace it. In thin animals with projecting trochanter, under the influence of violent pulling efforts or by slippings in which the hind legs are powerfully carried backwards in the act of extension, the aponeurosis of the *fascia lata* may divide at the anterior border of the muscle; the trochanter enters the solution of continuity, it is *hooked* in, so to speak, the muscle is immobilized and the flexion of the femur is impossible (Fig. 62).

The diagnosis is easy: the leg carried backwards and outwards drags by its toe. It is not necessary that there should be division or rupture of the aponeurosis to produce lameness; in very lean animals the muscle may be hooked back of the trochanter instead of passing over it well spread (Cruzel).

With good feeding and rest this difficulty may subside. Fat accumulating between the layers of muscles and infiltrating them makes the long vastus resume its place. Irritating frictions and blisters may be used also with advantage in this first stage of the disease.

But the action of these means is slow and uncertain. Generally practitioners prefer to operate—the only efficient treatment when there is

[1] *Dominik*: Mittheil. aus der thierärzthl. Praxis. (Gerlach und Leisering), 1856, p. 96.

rupture of the aponeurosis of the *fascia lata*. Various ways have been recommended. Some operate upon the animal standing, others while it is down. Quiet animals should be placed in stocks, others must be cast and secured. Dorfeuille, Castex, Cruzel, Bernard, Ringuet, Lafosse, and Boiteau have described the technic of the operation.

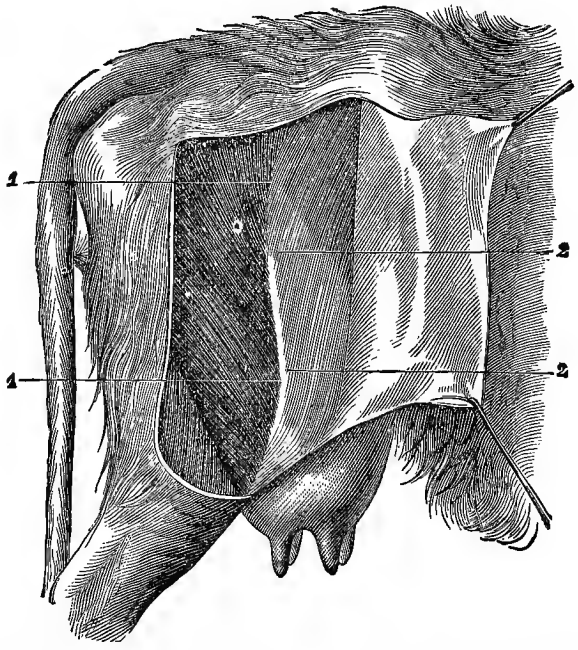


Fig. 62.—Fascia lata and long vastus in bovines. (1) Anterior border of the external ischio-tibial muscle. (2) Fascia lata (Cruzel and Peuch).

Two conditions present themselves: one in which the animal is thin, and the cord formed by the anterior border of the ischio-tibial is prominent and easily felt; the other in which the subject is in good condition, and it is difficult to locate the situation of the parts. In the first case, the section must be made subcutaneously. At eight or ten centimeters below the trochanter, the operator plunges obliquely the straight bistoury under the projections made by the anterior border of the muscle; and after a quarter-circle movement he draws it outwards, dividing the aponeurosis and the anterior border of the muscle. If the regularity of locomotion has not returned, the instrument is introduced a second time and the division completed. When the operator does not feel clearly the anterior border of the muscle, he must, on the same stop

as has been indicated, make an incision of the skin and fascia lata four or five centimeters long, introduce under the muscle a grooved director upwards and backwards, and then in the groove slide the bistoury and divide the aponeurosis and the muscle. "The obliquity of the incision, and a single introduction of the probe, not of the finger, are sufficient to facilitate the escape of the fluid, permit the strictly necessary division of the tissues and limit the inflammation unavoidably following the operation."[1] The special instruments invented by Boiteau, Gouze, and others are not necessary.

Sometimes a certain hemorrhage follows which requires plugging of the wound. Intramuscular abscesses and gangrene are little to be feared. Cruzel says: "I have operated at least two hundred and fifty times and have never observed deep abscesses or gangrene." This last complication is at any rate exceptional in cattle.

The luxation of the long vastus is *very rare in the horse.* A few examples of it are, however, recorded (Eletti, Strebel, Möller). In this species the long vastus has not the same anatomical disposition as in cattle, and its luxation, instead of taking place backwards, occurs forwards. The rupture of the muscle at its insertion on the ischium, or the fracture of the ischial tuberosity, seems to be necessary conditions for the production of this luxation (Möller). The muscle being displaced forward, the corresponding gluteal region is larger and more prominent than the other; its point is in proportion lowered, and when there is fracture, the postero-external angle of the ischium is no longer easily detected. The lameness resulting from this injury is incurable.

IV.

MYOSITIS.

Muscular bruises and ruptures are rarely accompanied with violent acute inflammatory phenomena, and, as in the case of all subcutaneous lesions, suppuration is the exception. On the contrary, open wounds are complicated with local suppurative myositis when the adhesive union of the edges of the wound is not obtained. Some surrounding lesions, especially the peri-muscular phlegmasia connected with abscesses or with lymphangitis, ordinarily spread to the superficial layers of the muscle, thus giving rise to simple or suppurative myositis, as the case may be. The treatment of these lesions derives its regulations from the therapeutics of contused wounds and of deep abscesses.

In the group of non-traumatic acute muscular inflammations one must recognize: (1) *Spontaneous* or *primitive myositis*, which affects the "work-

[1] *Lafosse:* Traité de pathol. vet., vol. ii., p. 573.

ing muscles" and is caused by severe muscular contractions, severe work or cold; (2) *symptomatic myositis*, which appears in the course of infectious diseases or intoxications.

Primitive myositis is frequently due to the struggling efforts that animals make when secured in a standing position, or hobbled while thrown down. Every practitioner has observed this. Although the ilio-spinal muscles are the most frequently affected, the muscles of the chest, elbow, shoulder or hip are equally subject to it. Ordinarily, the general manifestations are these: After a variable length of time, the day of the operation or the next, the animal is dull, the mucous membranes congested, respiration is accelerated, the thermometer registers 40 degrees to 41 degrees; a painful, hard, tense, and at times œdematous swelling appears in one or several regions of the body, most commonly along the ilio-spinalis; the animal walks stiff and sometimes with a great deal of pain. Through the inflamed muscles there are almost always partial ruptures and small hemorrhagic centers. In this form of myositis resolution is the rule. Whatever is the region affected, the severe symptoms of the first stage disappear rapidly, but there sometimes remains for several weeks a certain stiffness of the region.

With plethoric animals bleeding is useful. Low diet, sulphate and bicarbonate of soda given in drinks for several days are sufficient to remove all general disturbances. During one or two weeks there remains a certain functional deficiency of the muscle which must be treated by massage and resolutive or vesicating friction. As soon as improvement takes place moderate exercise hastens recovery.

If the inflammation is active, especially if there exists in some region a purulent center, muscular lesions may become complicated with suppuration (endogenous infection). The swelling increases, becomes warmer and more painful, and soon fluctuation is detected. Puncture allows the escape of a whitish or reddish pus containing sometimes necrosed muscular particles; the cavity is ordinarily very anfractuous. The myositis of the ilio-spinalis occurring in a horse suffering with "fistulæ of the withers" or "of the back," may become complicated with diffuse suppurative inflammation and extensive undermining. In one case of this kind we have found on the fourth day the ilio-spinalis infiltrated with pus.

When the lesions are not too extensive, the treatment of these muscular abscesses is that of purulent collections with or without undermining of the skin: puncture, free or counter openings, washing, drainage and antiseptic irrigations.

In all cases of serious myositis, the repairing process generally brings

on partial sclerosis of the muscle; there often remains a local stiffness and sometimes a lameness.

To this *myositis of casting* may be added that of long-continued use of the muscles and of overwork—*myositis by overwork. Myositis of the brachial biceps* is quite frequent (Gerlach, Günther). It is ordinarily observed in light draught or saddle horses after a quick and long trot. It is indicated by a lameness resembling that due to the inflammation of the tendon of this muscle and of its sheath over the bicipital groove, viz., an abnormal sensibility of the muscle and acute pains with the slightest pressure. Rest, revulsives and massage almost always bring on rapid recovery. Friction with a solution of ichthyol, 5 per cent., combined with massage, are peculiarly advantageous (Hoffmann). During warm weather Rey has often observed muscular inflammations limited to the muscles of the shoulder, to the dorsal region, or the croup. There occurred in those parts enlargements neatly circumscribed to certain of the muscles. "Puncture gave issue to a darkish blood, followed by a small quantity of reddish serosity." Out of ten subjects treated, resolution followed naturally or with the use of resolutives. "Among the modes of treatment used, the most efficient consisted in mustard frictions over the tumefied parts, which were almost always followed by diminution of the muscular swelling. Bleeding was performed also on some plethoric subjects." In market cattle obliged to take long walks before being slaughtered, tumefaction of certain groups of muscles and granular degeneration of those organs are frequently observed. These lesions give rise to a lameness more marked when the animal is cold; the affected region is warm and painful. In such cases Furlanetto has often found the subcutaneous connective tissue of the shoulder, arm, forearm, or of the internal face of the leg, infiltrated with bloody serosity; the muscles of the various regions being infiltrated, they are soft and darker in color than in the normal state. When the lameness is located in the hind leg the same alterations are observed in the muscles of the thigh. Similar accidents have been noticed in sheep and swine. The prophylaxis of this last variety of myositis is indicated by the etiology: that is, not to demand of the animals too tiresome or too long walks. As to the curative treatment, it consists of rest, local cold application, massage, resolutive frictions and alkaline salts in the drinks of the patient.

Rheumatismal myositis has been especially observed in horses, cattle and dogs, sometimes in sheep and swine. The muscles of the neck, shoulder, thigh and loins are more ordinarily affected. Several authors have related cases of muscular rheumatism more or less generalized in horses. The acute pain, its increase by pressure or motion, the absence of well-marked inflammatory phenomena, the erratic character of the

disease and its liability to a relapse justify a conclusion of rheumatism. The pain may involve several muscles; there are rarely subcutaneous œdemas; most often rheumatismal manifestations are not accompanied with local tumefaction, and it is seldom that the disease brings on atrophy. In general, pain subsides after a while when the animal is exercised; they stop after sudation. Sternomastoid myositis, which brings on the paresis or pseudo-paralysis of the shoulder, is rheumatismal in nature (Möller). Sometimes the mastoido-humeral is contracted, well defined and prominent, and the neck is incurvated (Bassi, Möller). Pulling on the leg and on the shoulder backwards produces pain more or less marked.

The course of this disease is acute, subacute or chronic. The acute form may disappear rapidly; quite often the affection remains in a group of muscles, becoming chronic.

The treatment must be both local and general. Whatever opinion one may have of the nature of rheumatism, it must be acknowledged that damp cold has a great influence upon its manifestation; therefore patients must not be exposed to it. The horse should be protected by blankets, the dog kept in a dry kennel; cold baths should be avoided. A cooling diet is prescribed: milk for old eczematous dogs. Upon the diseased muscles, dry frictions or those of camphorated alcohol should be made, with turpentine or ammonia. The former when pure, and the ammonia liniment, are peculiarly efficacious in the case of cattle. Warm washings and laudanum poultices may do good. If the affection has a tendency to become chronic, liniments, blisters and cauterization are useful. Setons are advocated by some. Later, muscular atrophy should be treated by continued massage and injections of alcoholic solutions of veratrin (.05 gram to .10 gram of veratrin, alcohol 1 to 2 grams). Walking exercise should be given during the excitement produced by these injections.

The internal treatment is less active. Old authors advise the use of emetics, the efficacy of which has not been proved. In later years salicylate of soda has been used and abused; 100 to 200 grams have been given to horses, two to eight to dogs. This salt has a remarkable effect in articular rheumatism, but it is now well known that it is less efficacious in muscular myositis. Sulphate of quinine, notwithstanding the happy results claimed by Caroni, is not more active. Friedberger and Fröhner have obtained good results with salol (15 to 25 grams for horses, .25 gram to 1 gram for dogs). For this animal antipyrine (.50 gram to 1 gram per day) is advisable). Some practitioners use the tincture of colchicum (ten to fifteen drops). Pilocarpine in subcutaneous injections, spoken of by Hübner, has given no success to Siedamgrotzky or to others who have tried it.

To keep the bowels open by purgatives is a prescription not to be neglected.

Symptomatic polymyositis, which constitutes a clinical concurrence analogous to polyneuritis, may occur during some infectious diseases. Under the title "Observation of General Inflammation of Muscles," Auboyer reported in 1833 the case of a horse in which, after serious general symptoms, a number of "muscular projections" appeared on the surface of the body, but the co-existence of swellings of the legs and of the head indicates that the case was more one of anasarca than of muscular phlegmasia. The polymyositis of hemoglobinuria is the much more frequent and the better known among animals.

Some polymyositis, which seems to have no relation with any determined disease, is of pyohæmic or septicæmic nature. In man it often represents a special form of common septicæmia.

Chronic myositis may follow acute. Sometimes it complicates the presence of hydatic cysts, psorosperms or foreign bodies. But in all animal species it may be observed without well-known causes. Möller, Kitt and Pütz have seen in the horse chronic myositis affecting certain groups of muscles (forearm, shoulder, thigh). At the autopsy of a horse which had been lame on both hind legs for several months, Möller found a chronic fibrous myositis of the croup and thigh muscles. Takarenko has seen similar lesions almost generalized in cattle. Like Möller, we have observed them in dogs, especially on the masseters. Psorosperms have been found in cattle, sheep, calves, swine and horses.

Chronic myositis ordinarily assumes the *fibrous* form, and may bring on muscular retractions and bony deviations, giving rise to serious disturbances in the joints. In the horse it is sometimes *ossifying*. Megnin and Palat have reported an observation of sclero-cartilaginous transformation of muscular tissue. Stephenson found the muscle flexors of the forearm completely ossified. But "progressive ossifying myositis" has not been mentioned in the case of animals.

Whether fibrous or ossifying, chronic myositis almost always resisted treatment. Locally, blisters and cauterization can be used, and internally large doses of iodide of potassium.

V.

AMYOTROPHIES.

Muscular atrophies, which are somewhat frequent in animals, especially in horses and dogs, vary greatly in their nature and in their causes. In all species we observe more or less marked emaciation, generalized to a whole diseased leg, and brought on by inaction or functional insufficiency of that leg. We have already spoken of the atrophy of certain muscular

groups, more particularly the crural or the gluteal, as frequent complication of hemoglobinuria. Rarer are the other amyotrophies of infectious origin. Arterial thrombosis may bring on serious nutritive troubles in the muscles that the arteries irrigate, and when the interference with the flow of the blood continues and the anæmic muscular zone cannot recover the conditions of its normal vitality, atrophy takes hold of it. Kützner has observed in the case of a horse, with no appreciable cause, a progressive atrophy of the femoral biceps and of the superior part of the semi-tendinous—atrophy, no doubt, of embolic origin, which three months later brought on troubles of locomotion. Slow atrophy of the large gluteus has been seen by Roloff, that of the pectorals by Blenkinsop. Other authors have recorded analogous cases in which several muscular groups were affected.

As more rare forms, some unknown, others scarcely mentioned in the case of animals, but frequent and well classified in the case of man, we may mention the *myelopathic muscular*, the *neuropathic* and the *myopathic atrophies*.

The *myelopathic amyotrophies*, which are met in numerous cases of myelitis, have a common origin; all come from a lesion of the cells of the anterior horns of the spinal cord. The anatomical and clinical development is at times rapid (*acute myelitis, hematomyelia*), at times slow (*progressive muscular atrophy*). Pure atrophy is the ordinary muscular alteration; in some cases it is accompanied with sclerosis (*sclerous atrophy*). Sometimes atrophy is systematic, progressive and predominant (*progressive muscular atrophy* of Duchenne); in other cases, though less marked, it nevertheless constitutes one of the prominent phenomena of the morbid group (*lateral amyotrophical sclerosis, syringomyelia*); and in other cases it is irregular, not at all prominent, and occurs in various stages of diseases, of which it is but an epiphenomenon of little importance (*sclerosis in patches*).

Neuritic muscular atrophies, which occur because of lesions of motor-nerves, have a more or less rapid development. Examples of them are common in some species, specially horses. (See *Paralysis*.) To that group to-day the *amyotrophies of articular origin* are added. They are sometimes marked by a rapidity that cannot be explained by the inertia or disuse of an extremity. It is admitted that they are of reflex nature, promoted by phlegmasia of the nervous branches which are distributed to the diseased muscles.

Myopathic muscular atrophies seem to be independent of all spina or nervous alteration—at least of all visible alteration—with the present method of investigation. They are considered as *primitive*, brought on by pohrtic troubles localized in the muscle itself. The diseased process be-

gins on muscular fibers, which first increase in size, break and waste away; the conjunctive tissue proliferates and becomes infiltrated with fat. Sometimes the affected muscles appear as if hypertrophied; but it is a pseudo-hypertrophy due to the increase of conjunctive and fatty elements: the muscular fibre is well atrophied. Erb has gathered the various myopathic amyotrophies under the name of *progressive muscular dystrophy*. The two principal forms of this group are the *pseudo-hypertrophic muscular paralysis* of Duchenne and the *progressive atrophic myopathy* of Landouzy and Déjerine.

The treatment of some muscular atrophies of neuritic origin and of those due to long inactivity, to arterial thrombosis and to various infections, demands especially: massage of the affected muscles, moderate at first, and gradually increased; irritating frictions upon the whole region occupied by the muscles in process of degeneration, and electro-therapeutics. (See *Paralysis*.) Iodide of potassium is sometimes useful.

Myelopathic and myopathic amyotrophies seem to be generally fatal. To this day they are considered as absolutely incurable.

VI.

PARASITES—TUMORS.

Parasites of muscles are numerous. The *psorosperms* and *trichinæ*, which inhabit the fibre itself; the *cysticerci*, *echinococci*, *botryomycetes* and the *actinomycetes* prefer the connective tissue. There are no agents which can destroy the cysticerci and the trichinæ; only a well-regulated prophylaxis can protect man and animals. Let us mention, however, the results said to have been obtained by Feletti in the treatment of human cysticercosis with the ethereal extract of fern.[1]

Against *hydatic cysts*, medical agents or puncture followed by an injection of iodine are now seldom used. Total extirpation, with curettage of the culs de sac, is the best remedy.

Primitive or *secondary* tumors may be observed in muscles. Their diagnosis is easy. The slow process of development of the neoplasm, its painless condition, and the absence of fluctuation are sufficient to indicate cystic collections and abscesses. The treatment consists in removal, unless countermanded by generalization. Lipomas, myxomas, enchondromas, sarcomas, and epitheliomas demand total extirpation.

Actinomycosic tumors should be treated with iodide of potassium, and in some cases should be extirpated. Those due to *botryomycetes* resist the iodine treatment or give way to it very slowly. (See *Actinomycosis* and *Botryomycosis*.)

[1] *Felelti:* Mercredi Médical, 1894, p. 417.

ADDENDA.

I. Spasms—Contractures—Cramps.

Cramps, their etiology and pathogeny, are still much discussed in medicine for the human species. It is generally admitted that they may result from muscular, nervous or vascular lesions.

Although the most of the observations reported in veterinary medicine under name of *cramps* relate to the displacement of the patella (see *Pseudo-dislocation of the Patella*), yet in all species, and especially horses, spasmodic muscular contractions and contractures analogous to the cramps of man are observed, which may occur and have no relation with the disturbances that may accompany painful cutaneous affections. Hirsemann treated a horse which, after a disease of the lungs, was affected with spasmodic contractions of the muscles of the neck and of the anterior leg on the same side as the affected lung; these contractions occurred by spells, and were brought on by the slightest touch on the affected regions; at the same time it lowered its head and flexed and carried forward the affected leg. The trouble lasted three weeks, and was finally relieved by subcutaneous injections of veratrin. Dycer has reported an observation of cramp of the flexor muscles of the head, which with the neck were flexed to such an extent that the nose touched the sternum; the front legs were carried forward and flexed; the animal rested on his knees, and his body was covered with perspiration. Attempts to raise the head were followed by great pain. After several hours the head and neck suddenly relaxed, the animal began to eat, and no further trouble was ever observed.[1]

Möller has seen a horse in which cramps would appear when slight irritations were applied to the auricular region. "The introduction of the finger into the ear would immediately bring on a violent contracture of the corresponding hind leg, which was then carried forward and for a few minutes held in an almost horizontal position. The animal was unfit for any work, as pressure of the bridle round the base of the ear would bring on the contraction. The ears and the peri-auricular region presented no visible alteration." *Contractures* of the olecranoid muscles have been recorded. In a case related by Möller, these muscles were tense, rigid and insensible to pressure; the animal was very lame; when at rest the elbow was carried outwards. In large animals, *contractures of the posterior legs* are sometimes observed at various intervals and of various duration.

[1] Dr. Nesbit has recorded a case of spasmodic contractions of the diaphragm (stumps), which was also accompanied with spasms of the masseter muscles, which had appeared after a comparatively short journey. He recovered rapidly by rest. (Amer. Vet. Rev., vol. xv., p. 452.)

They do not yield to treatment. Sciatic neurotomy tried with them has been unsuccessful.

II. Springhalt.

This is an affection of the hind extremities which is frequent in horses and observed also in mules (Bassi), donkeys and cattle (Booth, Furlanetto). An analogous anomaly has been observed in the fore legs (Rigot, Delabère-Blaine, Goubaux, Hering, Siedamgrotzky, Möller, Jacoulet and Barrier). In some cases the trouble is hardly noticeable, in others it is so marked that the foot strikes forward against the abdominal wall (Fig. 63). Although ordinarily it develops slowly, accentuating itself by degrees, there

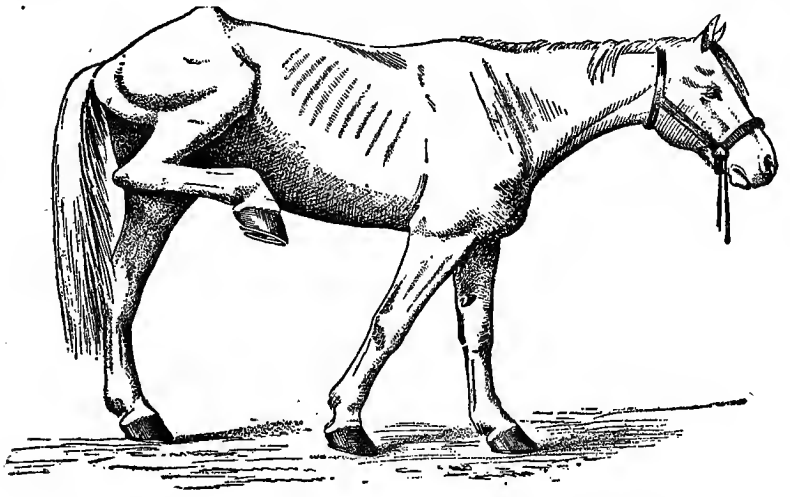


Fig. 63.—Horse affected with Springhalt. (From photograph.)

are individual cases in which it appears suddenly and without any appreciable cause.

A functional anomaly symptomatic of various affections, it is characterized by a sudden, convulsive-like flexion of a leg as it moves. Generally it is more easily observed in walking, not so easily detected during a trot or gallop. At times it shows itself only at the beginning of work, and disappears when the animal is warm; at others it is less noticeable after a little exercise; again, it may last as long as the exercise or work is going on.

Widely different opinions have been expressed in regard to its nature. Numerous authors think that it is the expression of *articular lesions*. Carlo Ruini, Solleysel, Jean and Gaspard de Saulnier, La Guérinière,

Abilgaard and Garsault have localized it in the hock; they had noticed its appearance in spavined horses. In one case Natté found on the articular surfaces of the tibia and of the astragalus reddish erosions with irregular borders. Busteed asserted that the hock was always the seat of springhalt, and that it was due to ulcerations of the astragalus. Varnell and Flemming upset that theory by saying that the American doctor had mistaken for an ulcer the synovial fossa of the trochlea of the astragalus! Rigot, Rey and Leblanc have observed true alterations of the tibio-tarsal joint, changes in the synovia, lesions of the synovial membrane, articular foreign bodies, wearing and fissures of the articular surfaces. In horses that had springhalt in the fore legs Goubaux and Barrier have observed fissures on the humero-radial articular surfaces, and in others that had it on the hind legs they have seen similar lesions in the femoro-tibial, femoro-patellar and tibio-tarsal joints. The influence of these lesions seems small, however, when one considers that they may be found in animals free from the trouble, or even may not be found at all in subjects that are suffering from springhalt. The dryness of the articular and tendinous synovial bursæ of the hock, due to a disease of the spine, has been considered by Comény as connected with the manifestation of springhalt. Barrier says that the too wide opening of the tibio-tarsal angle is the cause of it. The hock is not the only joint which has been supposed to be the seat of the disease. Villate, treating a lesion of the stifle joint in an animal that had springhalt, fired it; both diseases were relieved at the same time. Pastureau, Bassi, and Chuchu accused the stifle joint. Pastureau is of the opinion that springhalt and cramp in solipeds are but varieties, or two degrees of the same affection located in the femoro-patellar articulation, in which the *internal femoro-patellar ligament*, hooked on the inner border of the trochlea, plays a more or less important part. "If the hooking is incomplete, the flexor muscles entering into action meet a resistance readily overcome, to which succeeds a sudden flexion, convulsive like, carried to a greater extent than in normal state; hence the springhalt. If, on the contrary, the hooking is complete, the animal finds itself unable to flex the leg and the cramp exists."[1] Bassi and Chuchu have shown that it is not the internal femoro-patellar ligament which is hooked, but the patella itself, on account of a special disposition of the femoral trochlea. (See *Pseudo Luxation of the Patella.*)

Many have attributed springhalt to *muscular, tendinous or aponeurotic lesions.* For Lafosse and Bourgelat it is a lesion of the flexor muscles of the tarsus or of the nerves distributed in it. Boccar and Brogniez think that it is on account of the shortening of the muscles of the anterior tibial regions. Brogniez is said to have produced it experimentally by placing

[1] *Pastureau:* Journ. des Véter. du Midi, 1849, p. 483.

a wooden wedge between the metatarsus and the tendon of the lateral extensor of the phalanges so as to stretch it. L. Lafosse considers it only a perversion of the muscular contraction. He says: "It is only a spasmodic contraction of the flexor muscles of the metatarsus. We have removed it several times by the section of one or several of these muscles, which we have never found in that state of permanent retraction considered by Belgian veterinarians as cause of springhalt." Hertwig locates the afection in the excessive tension of the elevators of the thigh, and recommends for it the section of the *fascia lata*. Gunther thought it to be due to an insufficiency of action in the muscles of the croup. Delafond believed it a diseased stretching of the tibial aponeurosis, an opinion recently accepted by Dieckerhoff. After a minute study of the part played by aponeurosis in locomotion the Berlin professor has pretended that springhalt is due to the shortening of the tibial aponeurosis, followed in time by the atrophy of the flexor muscles of the metatarsus. In an interesting paper Wolf sustained the theory of Dieckerhoff. Orillard believes springhalt related to laceration of the muscles of the gluteal and posterior tibial regions or to partial ruptures of the cord of the hock.

The *nervous etiology* of springhalt has from the start counted many advocates. We have already named Lafosse and Bourgelat. Youatt and Spooner attribute it to the lesions of the great sciatic nerve, which "irritates too violently" the flexor muscles. Perciwall attributed it to disordered muscular contractions brought on by affection of the cord or the nerves of the hind leg. At post-mortem examinations of animals thus affected Renner has always found a chronic inflammation of the great sciatic nerve, and for him the spasmodic contractions of the flexor muscles of the tibia and hock must be due to this chronic neuritis. Vachetta, taking the theory of Renner anew, gives the facts a different interpretation. For him the paresis of the muscles supplied by the great sciatic nerve (biceps femoris, semi-tendinosus) gives rise to a predominance of action in the anterior muscles of the leg. Merle, Rousseau and Comény think that springhalt is due to medullary lesions.

Some authors attribute it to *foot alterations*. Watrin has advanced a theory that Weber, Lavalard and Montagnac accept for certain cases. He says: "By the action of the tendons of the flexor of the digits the flexion of the hock forcibly carries with itself that of the phalanges; then let us suppose that for any cause the flexion of the phalanges meets with an obstacle, the animal will make an effort to overcome it; if this disappears suddenly by reason of the force used, the flexion will be exaggerated, and in some cases springhalt will appear." Watrin especially suspects the contraction of the external quarter of the foot and the rolling in of the corresponding cartilage, which, hitting against the posterior face of

the second phalange, constitutes an obstacle to the free movement of the phalanges and produces the springhalt. Chénier thinks that springhalt is due to a lesion of the intra-horny tissues generally to pain or pressure taking place at given moments of the walk. To back his opinion, he says that horses that have cracks in the toe or the mammæ of the foot, or that have deformities of the hind feet, as in laminitis, do frequently have springhalt. He remarks that the symptoms diminish by exercise, as the tissues of the foot become accustomed to the painful irritations, and that if the disease were seated in muscles, tendons or aponeurosis, the irregularity of action would increase by work.

Like Gunther, many authors (Dieckerhoff, Bassi, Trasbot, Weber, Chuchu, and Möller) admit to-day that springhalt is a symptom of a great many different lesions. With Möller, springhalt can be divided into *idiopathic* (without visible occasioning cause) and *symptomatic*, when due to lesions of various nature and seat (bony diseases of the hock, scratches, blows, seams, laminitis, quittor, keraphyllocele, canker).

In fact, springhalt is always a secondary symptomatic affection. The spasmodic contractions which essentially characterize it are of a reflex order and promoted by lesions very diversified in their nature and localization, sometimes visible and at other times incapable of diagnosis, and often incurable.

Let us see now the forms of treatment recommended for it. We will speak only for memory's sake of the antispasmodics (belladonna, aconite, stramonium) used by Renner to overcome "the spasm of the posterior crural muscles." Vachetta has had some success with acupuncture and irritating frictions on the biceps femoris and semitendinous muscles, which, according to him, are in process of atrophy. But little can be expected from blisters or firing of the hock.

Some authors who, like Percivall, Lafosse and Merle, admit a nervous lesion, have tried the *resection* of the *anterior tibial nerve*, the principal branch of the small femoro-popliteal nerve. The operation is easy: The horse having been cast on the side opposite to the diseased leg, the operator, placed behind this leg, incises the skin parallel to the tibia on the external side of the superior extremity of the bone, where the nerve, easily found, runs in an oblique direction downwards and forwards. A second stroke of the bistoury divides the tibial aponeurosis, and the nerve, very near the surface there, is immediately exposed. The following steps are those of all nervous resections. This neurotomy has never given very satisfactory results.

The *section of the great sciatic nerve* (posterior tibial nerve) above the hock, succeeds when the lesions are seated in the inferior parts of the leg. (See *Tendinitis*.)

The *section of the tendon of the lateral extensor of the phalanges* was recommended by Boccar as early as 1845. Having found that tendon retracted and hard, he divided it at the point of its junction with that of the anterior extensor of the phalanges, and obtained a complete recovery. To perform the operation, the animal is cast on the sound side; the affected leg is either left in the hobble or carried over the corresponding fore leg; the skin is shaved and disinfected; the straight tenotome is planted on the posterior border of the tendon, then under it to the middle of its metatarsal region; the curved tenotome is then substituted for it. The instrument well in place, the tendon is divided by bringing it in contact with its sharp edge. The wound, covered with a little iodoformed collodion, cicatrizes rapidly by first intention. A removal of a small piece of the tendon (Delwart) has been suggested, but this practice has no real advantage except to retard the cicatrization. When the animal has got up, it is not unusual to see that the phalanges do not extend sufficiently, the fetlock flexes forward and strikes on the ground; but after a few days the regularity of the gait returns. There are cases in which, as in the first case of Boccar, springhalt subsides immediately. More commonly, the irregularity of the flexion motions disappears gradually, while cicatrization goes on, and the animal is given light exercise. It would be advantageous to have the animal walked during the time following the operation.

Performed by Delwart, Brogniez, Fœlen, Trinchera, Palat, Sergent, Guittet, Gérard, Humbert, Adrian and Blaise, this tenotomy is said to have been successful in numerous cases. Sergent has recorded fourteen observations with the following results: Nine complete recoveries, four almost complete, and one improvement. These are very encouraging. Out of six horses tenotomy of the lateral extensor has given to Adrian and Schelameur four successful cases, one half successful and one failure; Blaise has had two successful cases and one failure; Möller has also been successful. We have been less fortunate. Like Siedamgrotzky, we have failed in producing springhalt, operating as Brogniez did, and upon three affected animals the section of the lateral extensor has failed.[1]

According to Dieckerhoff, it is preferable, in case of principally long-standing springhalt, to cut both the tendon and the tibial aponeurosis. The horse having been thrown on the sound side, the shank is tied up above the hock with a cord or elastic ligature to cut off the circulation and facilitate the reaching of the aponeurosis at the place of operation.

[1] Dr. W. H. Curtis has operated on a large horse and removed about half an inch of the tendon, operating close to its union with the extensor pedes. The case was one of two years' standing and very severe. Recovery was perfect. (Amer. Vet. Rev., vol. xx., p. 497.)

The surgeon incises the skin below the hock on the terminal tendon of the peroneo-phalangeal muscle; in the incision he introduces the blunt tenotome upon the aponeurosis, which he cuts transversely. Then the pointed tenotome is introduced under the tendon and divides it transversely. The curved tenotome can also be used in this second step of the operation. Wolff has obtained several successful results with this method of Dieckerhoff.

Hertwig has recommended the *section of the fascia lata.* The animal having been cast on the sound leg, a short incision is made eight or ten centimeters below the angle of the hip, into which a grooved director is introduced under the fleshy portion of the muscle. The straight bistoury, guided by this director, divides the muscle from within outwards. In this way Bassi has cured a mule.

The section of the cord of the flexor metatarsi has been suggested. The animal is thrown on the lame leg, the upper leg being carried forward and secured on the upper fore leg. Above the hock the cord is easily felt. On a line between the lower and middle third of the tibia, with the straight tenotome the skin and tibial aponeurosis are punctured and pushed under the cord. The curved tenotome is then introduced in its place and the tendon divided from backward to forward. A coat of iodoformed collodion closes the wound and cicatrization takes place rapidly. But ordinarily the trouble continues as before.

Pare the foot plumb, taking for guide the axis of the digital region, and treat the contraction, if it exists, are the rules of Watrin's treatment. The unshod foot is poulticed with clay for several days, and then a shoe with ears is placed on it. Every ten or twelve days, the shoe is spread, the feet widen, the cartilages, "softened, do not longer hook against the second phalanx." In some horses whose feet are much contracted the springhalt subsides gradually and disappears with this treatment (Weber, Montagnac).

For Bassi, the *section of the internal anterior patellar* is the operation which offers the best chance of success. (See *Pseudo-Luxation of the Patella.*)

Upon an animal suffering with springhalt of both legs, we have successively, and without noticeable result, performed the section of the anterior tibial nerve, of the lateral extensor of the phalanges, of the plantar nerves below the fetlock, and of the cord of the flexor metatarsi. We intended to divide the internal patellar ligament, but we lost sight of the case. In another, where the springhalt was very severe (Fig. 63) we divided the great sciatic nerve on the lower third of the leg; four days after the operation the function of the leg was normal; a month later the

hoof sloughed off, and the patient was destroyed. The irregularity of the function had not returned.

It is seen that the therapeutics of springhalt is no less complicated than the etiology. To treat it properly, the cause must first be known. Correct the standing of the foot if it is defective, treat the painful lesions which may exist, perform the operation of Boccar, patellar desmotomy or sciatic neurotomy, according to the case; such are the most frequent directions. We are at present without means of treatment for the springhalt due to medullary lesions and muscular or nervous affections of the superior regions of the leg.

For the springhalt of the fore legs, if proper shoeing does not relieve it, plantar or median neurotomy might be tried.

CHAPTER IV.

TENDONS.

I.

CONTUSIONS.

All superficial tendons, but more particularly those of the extremities, are exposed to contusions. The tendons of the flexors of the phalanges of the anterior extremity, in animals that forge, overreach, or interfere, and those of the hind legs in animals that kick backwards, are at times the seat of an inflammatory, œdematous swelling, very painful, and due to bruised traumas. As will be seen later on, however, true tendinitis (*nerf ferrure*), in the etymologic acceptation of the word, is relatively rare. The inflammatory lesions of those tendons are almost always the consequence of sprains (*efforts*) or stretching produced during locomotion. On account of the structure and weak vascularity of the tendinous tissue, the ordinary characters of contusions are less marked than in other tissues; on the other hand, the progress of the inflammatory processes is slow and the pain often very severe.

The treatment is that recommended in the chapter on *Contusions* in general. Antiphlogistics first, massage and resolutives later, constitute the principal agents. (See *Tendinitis.*)

II.

WOUNDS

Wounds and *subcutaneous tendinous ruptures* will be considered separately. Although these lesions are manifested by functional signs about alike for a given tendon, their prognoses differ considerably. In ruptures, the traumatic center is protected from infectious agents, and cicatrization takes place quickly and almost always without complications; to avoid the elongation of the divided cord is all that the surgeon has to guard against. On the contrary, the wounds, like all exposed traumas, are subject to numerous complications, particularly to tendinous quittor or suppurative tenosynovitis.

In horses and cattle, *pricks* of tendons are particularly common on the

legs. The plantar aponeurosis is frequently affected by a puncture wound of the foot; the perforatus and perforans tendons are sometimes wounded at the canon or the fetlock by forks or other sharp bodies. At all times these lesions have been considered very serious; yet their rapid cicatrization is possible. What makes them dangerous is the infectious condition of the injuring body; if this does not deposit in the wound phlogogenous germs, there is only a temporary pain with production of a small fibrous nodule; which soon disappears. Like Furlanetto, we have sometimes seen remaining at the point of the cicatrix a morbid sensibility, occasioning lameness of long duration. On the contrary, wounds made with soiled instruments have a serious prognosis; too often they bring on acute suppurative tenositis, at times complicated with synovitis. (See *Tendinous Quittor.*)

Sharp or *bruising bodies* may produce longitudinal, oblique or transverse solutions of continuity of tendons. Transverse section is primitively complete in some cases; in others, the sound fibres break under the weight of the body or of a powerful muscular contraction; and again, a bruised, contused tendon may become the seat of a necrotic inflammation bringing on its complete rupture. Whether the division, however, is primitive or secondary, the final result is the same; peculiar functional disturbances appear in each tendon as soon as it ceases to fulfil its special part. The tendinous stumps are more or less apart; the upper one, pulled by the muscular contraction, draws up within its sheath; the lower one does not obey any more the articular motion likely to displace it; and often the space which separates them is filled with bloody exudation.

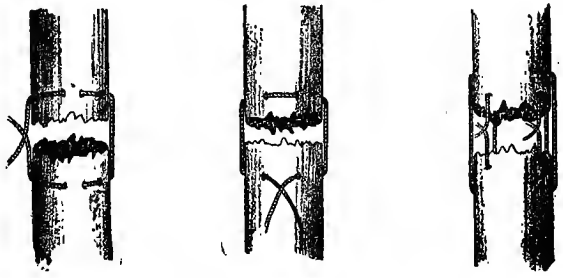
The treatment consists in disinfecting the wound, bringing the tendinous ends together and immobilizing the traumatic region. If the fragments of the tendons are close together and have but little tendency to become displaced, asepsis of the trauma, and a supporting bandage or a special apparatus to hold them in good position, will only be required. When the separation of the divided ends is well marked, it must be reduced as much as possible by acting upon the tendon itself or by modifying the position of the bony levers. In some cases suture is to be used; it gives excellent results in human surgery.

For *tenorraphy*, silk or silkworm-gut is preferred. When apposition is possible, without great extension of the tendinous ends, ordinary suture is sufficient. Composed of parallel fasciculi separated by connective tissue, tendinous tissue cuts easily; therefore, when it is necessary to employ a certain traction to obtain juxtaposition, it is better to have recourse to the means used in human surgery.

1. *Mode of Le Fort:* "Towards the border of the tendon (superior end), and from forward backward, a needle is introduced, carrying its

thread; then the opposite border is again run through by the needle from backward forward, thus forming a loop on the anterior face. The same process takes place with the lower end, but in passing the two threads successively from backward forward, and then twisting or knotting them together." (Fig. 64.)

2. *Mode of Wölfler:* "The thread passes through the upper end twice, then through the lower end also, and is secured on the side."[1] (Fig. 65.)



Figs. 64, 65, 66.—Tendinous sutures.

3. *Mode of Le Dentu:* "In which there are two sutures, one of juxtaposition and one of support, which are passed through both tendinous ends." (Fig. 66.)

When it is not possible to bring the ends together, a *suture apart* is made with catgut, or the *suture by anastomosis.*

Then a cutaneous suture is made with or without drainage, and a dressing put on; the non-resorbable threads are removed after four or five weeks. Long rest is necessary.

Up to this day but few operations of this kind have been performed on animals, and the results have not been brilliant. Upon a steer whose tendo Achillis was cut, Furlanetto sutured the ends with silk, but all antiseptic precautions not having been carried out, the wound suppurated, the sutures became loose, and the tendinous ends necrosed. (See *Wounds of the Cord of the Hock.*) As the author says, this failure could have been avoided with vigorous antisepsis.

When suppuration is already present, or if there is partial necrosis and tendinous sloughs, then tendons surround themselves with a thick fibrous cicatricial layer which unites the tendons to the surrounding parts, and the movements return only very incompletely. At times the leisons are very extensive. In a steer wounded on the right hind canon with the blade of a plow, Furlanetto found a section of the perforatus, perforans

[1] *Lejars:* Traité de Chirurgie de Duplay and Recher, t. 1, p. 815.

and internal branch of the suspensory ligament without any injury to the principal metatarsal bone. In cases where such serious lesions exist, and in general where there is complication of synovitis or arthritis, no treatment is justifiable.

SPECIAL TENDINOUS WOUNDS.

All superficial tendons are exposed to traumatisms; all can be involved in wounds. On the extremities these lesions are peculiarly common on the *cord* of the *hock*, the *extensors* and *flexors* of the *foot*.

I. Tendo Achillis.

On account of the situation and the projection above the point of the hock, the tendo Achillis and the tibial portion of the perforatus, they are much exposed to external violence. Their complete section, observed in horses, cattle, dogs and swine, brings on the functional incompetency of the leg. If the animal rests upon this leg, the canon flexes under the weight of the body, the croup drops down on the corresponding side, the posterior face of the metatarsus and of the tarsus has a tendency to come into contact with the ground, and it walks like a plantigrade (Fig. 67).

Spontaneous recovery may occur in all species. Bouley, Jr., mentions the case of a horse which recovered spontaneously from a complete section of the tendo Achillis produced by the thrust of a sword. Four months afterwards there remained no trace of the accident. St. Cyr has seen a six-month-old pig recover without any care, and also a heifer which had rupture of the cord of the hock with extensive wounds and sloughs. Collin records the history of four dogs upon which the cord of the hock had been cut on one leg to prevent them from running out with a hunting party; four months later they ran off again, when a similar operation was performed on both hocks; six months later they were permitted and able to return to their hunting.

These natural recoveries are not, however, to be depended upon, and in all cases the practitioner must try to reduce the extent of the cicatrix, which is often accompanied with a great elongation of the tendon—even of seven centimeters in the case of Barthélémy, which required the destruction of the horse.

To keep the tendinous stumps in contact and prevent complications are the two principal objects in view. This is no easy task in our large animals. The patient should be placed in a suspensory apparatus (slings) and the leg immobilized in extension. For this several means are recommended. To hold the two hind legs together with hobbles (Delorme) is not enough. To fix the leg in extension with a hobble, the chain or rope of which is secured to a wall behind the animal (Vigney), seems to

us not at all practicable. Collin, having to treat a saddle mare whoses tendons were cut, surrounded the hock with oakum, applied wooden splint, on each side of the hock, and held those with bandages. Excoriations of the skin demanded the removal of this dressing. The mare recovered and four months afterwards it was difficult to see that she had been so seriously injured. Gillet has had recourse to a more complicated treatment. Two flat pieces of wood (splints) were cut to fit the lateral faces

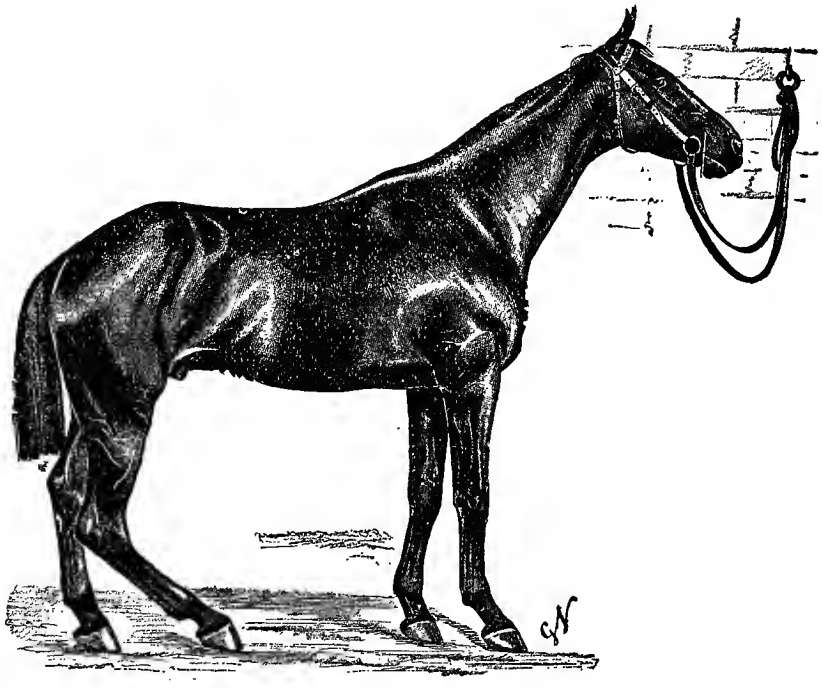


Fig. 67.—Section of the Tendo-Achillis (photograph).

of the regions extending from the superior parts of the shank to the fetlock and then to the ground, and after being well padded were secured on the injured leg by three leather straps. The animal was kept in slings thirty days; after that was turned loose. It was five months before he could resume work. While the walking was regular there remained a slight lameness in trotting. The *apparatus of Relier* might be used with advantage in such cases. (See *Fractures*.)

By careful disinfection and some stitches of suture the adhesive cicatrization of the wound is possible, but ordinarily suppuration occurs.

For the dressings tepid antiseptic solutions and iodoform are preferable to the tincture of arnica or aloes used in past times. Recovery is always slow; generally the lameness does not subside for three or four months. The tendinous suture has been tried by Furlanetto in a seven-year-old small cow, in which the skin and tendo Achillis had been cut five centimeters above the os calcis. The animal was operated upon standing. The leg being held in extension, the tendinous ends were held together with two thick silk threads and the cutaneous wound closed with an interrupted suture. The leg was enveloped in oakum, an iron splint was placed on the anterior face of the leg and wooden splints on the two sides; the whole was kept in place by an immovable dressing. The animal having been left free, showed no serious symptoms. A strict antisepsis had not been used, on the eighth day there was escaping from the wound a fetid, yellowish fluid; two days later necrosis of the tendinous ends was observed. The animal was destroyed.

II. Tendons of the Extensors of the Phalanges.

The tendons of the anterior and lateral extensors of the phalanges may be the seat of complete transverse solutions of continuity. The digital region is no longer extended on the canon and the anterior face of the fetlock participates in the support of the leg, as in cases of paralysis of the external sciatic popliteus.

When at rest, the fetlock having but little tendency to flex forward, the dieresis of the extensor tendons is less serious than that of the flexors. By immobilization and simple care of the wound the union of the tendinous ends takes place rapidly and the normal functions of the leg soon return. In one case of a wound of the anterior face of the right posterior canon, with rupture of the tendon of the anterior extensor of the phalanges, Chaintre first used white lotion; a piece of bone sloughed out, the wound was then dressed with alcohol and tincture of aloes. Protruding granulations and a fistulous tract retarded the cicatrization, which took seven weeks. As the tendinous stumps had not been kept closed together a fibrinous band five centimeters long took place between them; extension remained imperfect for a long time, but the leg ultimately recovered all its normal functions.

An antiseptic treatment would be followed by a more rapid recovery and would prevent infectious complications.

III. Tendons of the Flexors of the Phalanges.

Partial cuts and contused wounds of the *flexor tendons* ordinarily are repaired without complications when treated antiseptically. Exceptionally, the wounded tissues, especially the paratendinous connective tissue, be

come the seat of a hypertrophic chronic inflammation, which results in the formation of a fibrous tumor that may acquire large dimensions. We have operated upon a horse affected in the left hind leg with a similar lesion of one year's standing (Fig. 68). The growth was removed with the bistoury and the wound covered with an iodoform dressing. The cicatrization was completed in two months.[1]

Fig. 68.—Fibrosu Tumor Developed after a Contused Wound of the Flexor Tendons of the Phalanges. (Photograph.)

The section may involve either of the tendons or both at the same time, and occupy the coronet or the metacarpo-phalangeal region. Less serious when in the middle of the metacarpus than when on a level with the tendinous sheath, it is manifested by a dropping of the fetlock, more or less marked according to the lesion. If, as in the case of Lapôtre, the perforatus alone is cut, the fetlock drops backward but little, but if both tendons are involved and, *a fortiori*, if the suspensory ligament itself is injured, the deviation of the fetlock is well marked, and at times the ergot comes in contact with the ground (Clichy, Bouley, Degive, Brandis). In a number of cases, those of Bouley and Louis among them, recovery has been obtained by irrigation or simple dressings without the use of any special apparatus. In Louis's observations the horse had both tendons cut, the sesamoid sheath was widely open and the bone involved. The horse, being very nervous, was put in slings. Treated with continued irrigations and dressings with chloride of lime, he recovered in two months. Lapôtre applied a shoe with heels four centimeters high to prevent the dropping backward of the fetlock; the wound having been well washed was covered with a dressing and filled in thirty-five days. Thick heels and elongated toe-

[1] We had a case similar to the one represented in Fig. 68 of several months' standing, in which amputation, dissection and cauterization failed to control the constantly rapid increase of the growth. We at last resorted to the use of compressed sponges, and after six weeks of careful dressing succeeded. The case was recorded by Dr. Walrath.—American Vet. Review, vol. x., p. 267.

shoes were applied later. The animal was gradually returned to its work. When both tendons are cut the fetlock joint must be supported to prevent the too wide separation of both ends of the tendons. For this, as advised by Bouley, one may use a shoe with long branches bent upwards and resting backwards on the phalangeal column, and thus preventing the dropping of the fetlock. By this means the tendinous cicatrix is short, and its retraction permits the return to normal standing of the digits. Clichy, having to treat a complete section of the flexors of the right hind leg, had a bar shoe made with long toe and long branches,

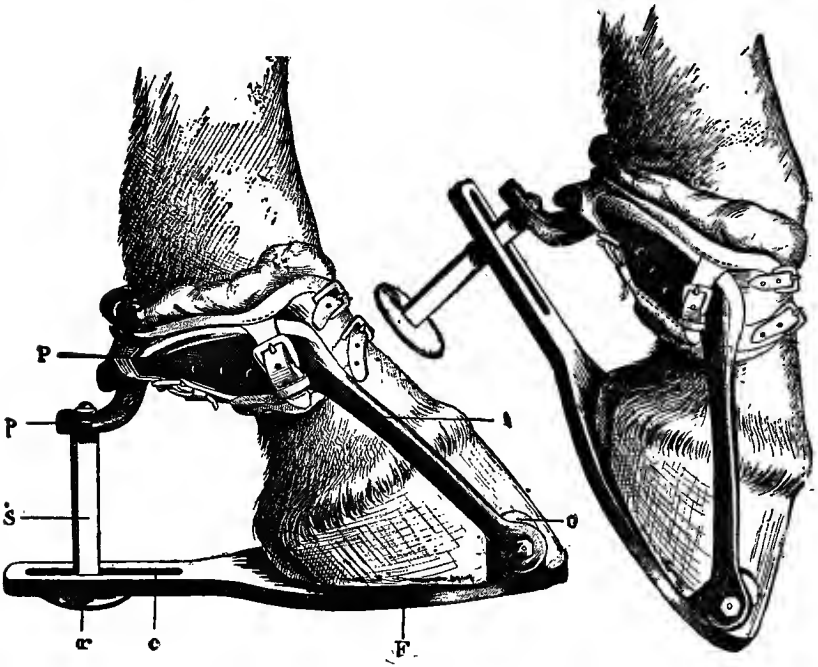


Fig. 69.—Apparatus to support the fetlock in cases of section of the flexors tendons of the foot. (Defays).

and having at the toe and middle of the bar two holes with thread, to which were screwed two metallic rods extending to the hock. These, well padded, were secured above and below the hock with leather straps. A simple dressing of tincture of aloes with adhesive plaster was put on and the animal left at liberty.

Gourdon and Brogniez have also recommended special apparatus to support the fetlock. But all present more or less inconvenience which does not permit of their use in all cases; besides, the fact that the limited

and continued immobilization of the parts, which they require, may bring on ankylosis.

To obviate this inconvenience, Defays has invented a special apparatus which has given him very good results, and has the advantage of permitting motions up to a certain extent, and prevents the possibility of gangrene. Like all others, however, the apparatus demands watching.[1]

Some authors prefer to these special apparatuses, fenestrated immovable bandages. These are made with starch, plaster or other like substance.

To resume, in the presence of a section of the flexor tendons of the foot one must: (1) Place the animal in a sling or let him loose in a box; (2) apply upon the lower regions of the leg a supporting bandage or one of the apparatuses above named (shoe of Bouley, orthosome of Brogniez, apparatus of Defays), which are used to prevent the dropping of the fetlock; (3) treat the wound with antiseptic dressing or continued irrigation.

In the fortunate cases, after thirty or forty days, the tendinous continuity is re-established, and the supporting apparatus can be removed. To avoid too much straining of the cicatricial tissue, a thick high-heeled shoe should be put on. Towards the end of the second month the animal can resume work. There may remain a little lowering of the fetlock, but with the gradual retraction of the tendons, this will soon disappear. With small animals, the suture of the tendons would shorten the duration of the repairing process.

III.

SUPPURATIVE TENOSITIS—TENDINOUS QUITTOR.

The inflammation of the tendons—*tendinitis*, *tenositis*—is *primary* or *secondary*, *aseptic* or *infectious*. It will be seen further on that with subcutaneous lesions it has a tendency to resolution, when not kept up or aggravated by muscular action or tractions made upon the diseased tendon. In exposed lesions, on the contrary, the tendinous tissue, inflamed, softened and infiltrated with pus, is often affected with partial necrosis, which gradually spreads, sloughing being powerless to eliminate the whole of the diseased "core" and stop infection. This necrotic inflammation of the tendons is frequent on the inferior regions of the legs, where it is still called by the old name of *tendinous quittor*.

This is the affection described by old hippiatres under the name of "nervous quittor." According to most of them the essential lesion affected the tendons; according to Lafosse, Vitet and others, it was an in-

[1] *Defays:* Annales de Medec. Vet., 1858, p. 577.

flammation of the large sesamoid sheath. Pathological anatomy tells us that there is at times tenositis and again teno-synovitis.

The suppurative inflammation of the tendons of the extremities has infection as its essential cause. As a frequent complication of abscesses, overreaching, cutaneous quittors, synovitis and wounds of all kinds affecting tendons, it is early manifested by positive phenomena: by very great lameness, excessive dumbness, tumefaction and induration of the region, and by the presence of one or two fistulæ, and a large amount of pus escaping from them. A necrotic center is soon formed; by infection of surrounding parts, the disease spreads gradually; the weak vascularity of the tendinous tissue, the density of its structure, and its slow vitality render the entire separation of the slough very difficult.

This affection always admits of a strict prognosis; it may, however, vary with some circumstances. The necrosis of the anterior extensor of the phalanges is much less severe than that of the flexors, and among those the lesions of the perforans are the most dangerous. Whatever be the organ affected, the disease is so much the more alarming as it is located nearer to the hoof; and also one must always count upon possible complications, especially bony lesions, synovitis and arthritis. The necrotic lesions of the metacarpal sheath and the bands of the aponeurosis of the perforans and of the plantar cushion are less serious than true tendinous quittor—at least they give rise to less lameness and less pain than tendinous quittor.

When tendinous quittor exists with all the conditions for its development, it may nevertheless in some cases be arrested. Cutaneous quittors treated antiseptically (baths, damp compresses and wadded dressings) rarely become complicated. If the case is neglected, the dividing fissure between the slough and the healthy tissues spreads deeply, the pus reaches the tendons, remains on their surface and often starts a partial necrosis. Peri-tendinous abscesses must be opened early, disinfected and drained. In suppurative synovitis tendinous alterations are also prevented by free cuttings and antiseptic treatment. We have already stated how wounds of tendons are to be treated. (See *Tendinous Wounds.*)

For tendinous quittor itself, several therapeutical methods are offered. Let us mention only to condemn the method of treatment in which poultices or warm compresses are applied to the diseased region without a free opening first of the fistulæ. Some practitioners have recourse still to this method; but it is insufficient and dangerous. It does not arrest the necrosis, but gives exposure to the most serious complications.

To assist the flow of the pus and insure the action of the medical agents as directly as possible upon the diseased parts are the rules common to all cases. The direction and the situation of the fistulæ should be carefully noticed. Some are deep, undermining, and the pus filtrates

along the tendons and collects in a large cul-de-sac; the tracts must be enlarged, the pus given free escape, painful pressures relieved and the necrosed tendinous part freely exposed or removed. Incisions should be made parallel to the axis of the leg, avoiding the blood vessels and nerves; the fistulæ should be curetted and the purulent pouches disinfected with antiseptic washes. Should profuse hemorrhage occur, plugging with iodoformed dressing should be applied.

The therapeutic agents recommended have varied with the various epochs of their introduction. *Actual cautery* to a white heat, applied on the mortified tendinous part, has given and yet gives good results: it modifies the putrid into an aseptic eschar, and the surrounding tendinous tissue may remain free from infection and recovery may take place. But this process is not sufficiently sure; the cauterization is either too much or not enough; and often the necrosis keeps on, even after an extensive slough has taken place. Among the *caustics* used in the first two-thirds of this century, corrosive sublimate, in powder or in pencil, introduced into the fistulæ, arsenious acid, nitrate of silver, and sulphate of copper have been recommended.

A large number of liquid, caustic or disinfecting preparations have been recommended for tendinous quittor. Two among these —Villate solution and tincture of iodine—have proved themselves especially advantageous, and they are still extensively used. When injected several times a day into the bottom of the fistulæ, at the same time carefully preventing contraction of these by the introduction of tents or plugs, they have often brought on recoveries. With baths of sulphate of copper, 4 to 6 in 100, repeated twice a day, Rey and many others have obtained excellent results. The great objection to very strong solutions is that they have too powerful an escharotic effect on the skin of the soaked regions. Aureggio has advised the use of *glycerine*. Carried into the focus of the necrosis, it may, like the preceding agents, clean off the fistulæ, the undermined spaces, and the exfoliated part of the tendon.

Antiseptic treatment is to-day preferred to hydrotherapeutics. Iodoform, in powder or united with vaseline or glycerine, has proved itself very active. We have used it with great advantage. More or less concentrated solutions of corrosive sublimate are also precious agents. They are used in strength of 1 in 1000, 1 in 500, or 1 in 100 (water 100, glycerine 10, corrosive sublimate 1). At present tendinous necrosis is especially treated with antiseptic liquids. Free incision, drainage, antisepsis, is the formula. Often in the course of the disease, when synovitis complicates tenositis, abscesses have to be punctured, counter-openings are to be made and new drains applied. If the antiseptic irrigations are well done, little by little the suppurations will become less abundant, the pus will change

aspect, the indurations and the sensibility diminish, the pain subside, the rest of the leg be better, and the fistulæ close. But tendinous quittor is obstinate. Sometimes the treatment demands six weeks or two months. For lesions of the bands of the plantar cushion, or the bands of insertion of the strengthening aponeurosis of the perforans, or those of the metacarpo phalangeal sheath, the directions are the same.

When once recovery is brought about, generally the organs of the region are united by inflammatory induration; when the quittor has involved the flexors, the great sesamoid sheath has disappeared, the tendons are ankylosed and their action greatly hindered. With exercise, baths and massage, these disorders may gradually subside. In a number of cases, when the acute inflammatory phenomena have subsided, cauterization with deep points or with needles made on the diseased part will hasten the absorption of the induration. If the remaining lesions are such that lameness is persistent, median or sciatic neurotomy is to be prescribed.

But the termination is not always so good. Sometimes during the disease serious accidents may occur. The diseased leg being unable to carry its part of the weight of the body, its congener, overloaded, is exposed to laminitis. With tendinous necrosis, suppurative synovitis, bony necrosis and arthritis may make their appearance. A time arrives when, emaciated and exhausted by pain, the patient remains continually lying down, dry gangrene of the skin occurs in patches, and the animal has to be destroyed. Also, in cases of purulent infiltrations, pyohæmic symptoms manifest themselves and soon carry off the poor suffering beast.

IV.

TENDINOUS RUPTURES (BREAKINGS).

Tendinous ruptures, partial or total, are generally the result of violent muscular efforts. At times there is a special predisposition or an alteration of the tendinous tissue which promotes the rupture: thus are explained the facts of multiple ruptures observed in a single subject. Rheumatism, simple, chronic, or suppurative tenositis and the navicular disease seem to be the most frequent causes of the softening of tendons. Möller and several other authors have reported cases in horses of ruptures of the four perforans tendons. To Braüer is due the following curious record: In a horse suffering from anasarca and kept in absolute quiet for a certain length of time, the flexor tendons of the phalanges had become so elongated that the fetlocks rested almost on the ground; the animal walked like a plantigrade; the tendons and peri-tendinous tissues were neither tumefied nor painful; after four months the tendons had returned to their original dimensions, the legs recovered their normal standing and the horse was able to return to its work. Numerous facts, however, show

that a violent muscular contraction may produce the rupture of a sound tendon.

Thirty-four observations of tendinous ruptures recorded by St. Cyr in 1854 are classified as follows: Cord of the flexor metatarsi, 21 cases; flexors of the foot, 10; suspensory ligament, 1; tendo Achillis, 1; anterior extensor of the phalanges, 1. Many observations gathered from all the clinics can to-day be added to this list.

Though the paratendinous connective tissue co-operates like the tendon itself to the cicatrization of complete or incomplete ruptures generally, the prognosis is serious. With tendons of the extremities it is sometimes advantageous to destroy the animals at once. If the lesion is protected from the air repairs will take place regularly, but months must pass before the leg is again useful. Injuries of the flexor tendons are more serious than of the extensors. If suppuration occurs necrosis of the tendon is to be feared, and the prognosis is still more serious.

The treatment of tendinous ruptures demands three principal precautions: (1) Give to the leg the position in which the ends of the tendon are closest to each other; (2) insure the steadiness of the parts by a special apparatus or solid bandage of plaster or pitch; (3) give the animal a long rest. Treatment is justified only when the rupture is free from previous degenerations. After recovery the tendon is generally elongated and locomotion more or less interfered with. In time these are remedied and perfect health returns. Here again the ideal form of treatment would be to expose the traumatic center and sew up the stumps of tendons. For certain tendons, if the operation were performed aseptically and completed with a plaster dressing or a special apparatus, it might give good results. A few attempts have been made in this direction, but up to this time have proved unsuccessful.

SPECIAL TENDINOUS RUPTURES.

I.—Tendon of the Infra-Spinatus.

This, though extremely rare, has been observed by Bouley at the Alfort Clinic, on two horses cast for surgical purposes.[1] It was characterized "by a marked deviation of the scapula and humerus at their point of juncture. When the leg was put down, both bones made an angle projecting well outwards."

Bouley says one need not worry much over the seriousness of the accident. Place the animal in a sling, and apply a blister over the part, is the treatment required. The union of the two ends cannot but take place.

[1] Bouley, Bullet. Soc. Cent. Med. Vet. 1864, p. 392.

The rupture of this tendon is always possible, but it is principally produced by any violent traumatic action applied on the shoulder, on a level with the tendon. We may remark that the two cases reported by Bouley were more likely to be paralysis of the sus-scapular nerve, than lesion of the tendons. The functional troubles described were those of such paralysis, and no *local symptoms* are described which must have been present, if there was a tendinous lesion. The result of the experimental section of the tendon, made to confirm Bouley's diagnosis, does not prove it; both section and paralysis being accompanied with the same symptoms.

II.—Cord of the Flexor Metatarsi.

Of all tendinous ruptures, this is the most frequent and the most studied. The ordinary causes of the accident and the troubles that it produces are well indicated by Solleysel. "From a struggle while in stocks, from an effort while being shod or in going down a very steep hill, from fall, or from being entangled under a heavy load, the *big nerve* of the hock may stretch and twist with so great a force, that it becomes soft and relaxed as a loose cord; *when the animal walks, the leg hangs on the hock, loose, as if it were suspended.* One might believe that the bone is fractured, so greatly is the action of the leg different from the normal; when the animal rests its foot upon the ground and the hock is extended to its natural extent, the standing of the foot is good; there seems to be but little or nothing out of the way."

Although Solleysel well indicated the causes and symptoms of this affection, he was ignorant of its nature; for he thought the lesion consisted in a stretching and elongation of the tendon Achilles. The observations of Barthelemy, Bouley, Jr., and Renault have since explained the character and the diagnosis. Rigot explained the mechanism of the accident by experimental sections of the cord of the flexor metatarsi. Vatel, Feslat and Furlanetto have recorded observations in the case of cattle.

The rupture of the tibio-pre-metatarsal muscle takes place at various points of its length; sometimes at its femoral insertion, between the external condyle and corresponding border of the femoral trochlea (Goubaux). When the rupture of the cord takes place in the tibial region, the ends of it, immobilized by the muscular layers between which they are inclosed, readily cicatrize; when it takes place at the superior extremity of the muscle, the continual motions of the point prevent cicatrization.

If an animal thus affected is made to walk, the femoro-metatarsal cord, not transmitting to the canon the flexion of the femur, and the fleshy portion of the muscle being powerless in taking its place, the canon is no

longer flexed on the shank, and remains powerless below it, the phalangeal column hangs vertically or in very slight flexion. The foot is raised from the ground, like that of the sound leg; at times only, the toe touches the ground. The tendon Achilles, no longer subject to the counteraction of the flexor muscles, is flabby, shrunk, perhaps bent in two in the middle or near its insertion into the os calcis (fig. 70). By carrying the canon bone backwards, one may succeed in placing the shank, the hock and meta-

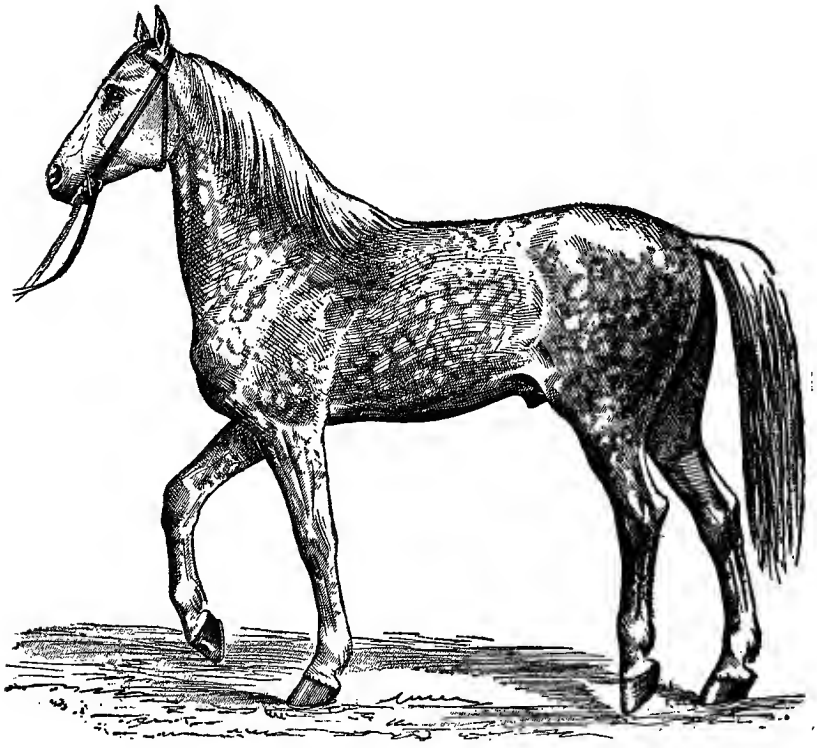


Fig. 70.—Rupture of the cord of the flexor-metatarsi.
(From a photograph.)

tarsus on a straight line, which made Louchard say that "it looks like a complete luxation of the hock."

When at rest, everything is changed; no matter how serious were the symptoms exhibited while the animal was walking, they have disappeared: the leg, which a moment before was powerless, participates now in the support with the entire inferior face of the foot. The severe prognosis made must be modified.

When the accident is the result of a blow on the anterior face of the

tibia, or if with the rupture of the cord there is partial laceration of the muscle with a more or less abundant bloody exudation, the anterior face of the tibia presents either a wound, or only a tender, œdematous part; the inferior part of the leg may be the seat of a swelling, more or less prominent. But when the rupture is the result of a forced extension of the leg, it keeps its normal clean appearance. In both cases, the symptoms observed during walking are characteristics and the diagnosis is easy. The exploration of the leg will always permit one to avoid the error of Barthelemy, who believed that it was a case of fracture of the tibia.[1]

In this rupture, the ends of the divided cord do not spread apart very much, the treatment is very simple, and complete recovery is the general rule. The animal must be left in absolute rest, loose in a box-stall. To put splints and a pitch bandage on it, as did Solleysel, is useless. Emollients, douches and padded dressings have been recommended. A rest of four to five weeks is sufficient to obtain a recovery, both ends of the cord uniting spontaneously. Vesicating applications are not necessary, though they accelerate the repairing process; the local pain that they produce insures the more complete immobilization of the leg, and while the leg is covered with the crusts of the blister, the owner is more willing to leave the animal at rest. As it is not always possible to find the spot of the

[1] In a series of experiments which we have made, we have observed a difference in the symptoms. In one case where we divided the tendon only a little below its passage through the groove between the external and anterior tuberosity of the superior extremity of the tibia, the animal showed all the manifestations observed in all similar cases I had observed, at once. In a second case, where we had divided the muscular portion only, we observed that when the horse walked away from the bed, his action was perfect, the leg being carried away without trouble, the hock well flexed. In a third experiment, an incision was made just above the tibio-tarsal joint, the tendon of the anterior extensor pedis well isolated and then the entire structure of the muscle, which is there mostly tendinous, was divided. Immediately the animal drags his toe with much difficulty, knuckles considerably at every step he takes; the tendon Achilles is more marked than in the subject of the first experiment. When the animal is turned round on the operated side the action is more difficult, the leg is carried more in adduction. Still the standing is firm on both legs and when in his stall the animal seems in perfect health.

From these experiments I concluded (1) the rupture of the fleshy portion alone of the flexor metatarsi will not give rise to the symptoms of the cases recorded; (2) rupture, laceration or division of the tendinous portion alone in the upper part, from its origin to the point of union with the muscular fibres, will give rise to the difficulty of flexion at the hock; (3) rupture or division of the lower portion of the muscle or of any part of the muscle where tendon and muscle are united, will also give rise to the same symptoms, but probably more marked, with greater difficulty of flexion at the hock and impaired coördination of the movements.—(Amer. Vet. Rev., vol. 3, page 263.)

rupture, a blistering application is often put the entire length of the tibial region. It is rare that permanent difficulties of locomotion would follow. Solleysel has said: "Horses are able to perform their work afterwards as before; but it takes more than one day." Before return to work, it is important that both divided ends of the cord shall be strongly united by cicatricial tissue.

We have said that the ordinary termination is complete recovery, yet there are cases in which it is not obtained. In an observation of Vatel, the rupture, which had taken place at the upper part of the tibia, was followed by an irregular repair in the trauma, with adhesion of the cord to the bone of the leg and atrophy of the anterior extensor of the phalanges and muscular portion of the flexor; the animal had to be destroyed after seven months of treatment, lameness remaining all the time. Bouley has met with several failures. In one horse treated by us for a rupture which had taken place near the superior insertion of the tendon, there was no flexion of the canon, even after four months. This trouble gradually subsided but did not disappear entirely. These cases are, however, exceptions.

Festal has obtained a complete recovery in twenty and thirty days in the case of cattle.

III.—Tendon-Achilles.

The rupture of this tendon may take place at various points, sometimes at the very origin of the tendon. At times it is primary and occurs on a sound tendon; at others it is preceded by changes in the tendinous tissue. Uhlich has seen it in a horse after influenza. Schrader found in a cow the tendon ruptured on both legs. Most commonly it is primary and affects but one leg, and is the result of external violence or powerful effort. The observation of Vatel refers to a young goat, which, having jumped from a third-story window, ruptured the cord of the hock; the two ends were four centimeters apart. The leg was kept six weeks in extension by splints and bandages, and recovery was perfect.[1]

For all kinds of valuable animals, treatment may be attempted if the lesions are not too serious. With small patients, one may, as Vatel did, place the leg in extension and hold it there with bandage. The dressing recommended by Detroye for fracture of the calcaneum may be used for

[1] In the case of Schreibler, House Surgeon to the Hospital Department of the American Veterinary College, a dog had struck one of the barbs of a wire fence and severed the tendon Achilles. The separated ends of the tendon were one inch apart. The leg was put in splints and recovery occurred in four weeks.—(Amer. Vet. Rev., vol. 9, page 467.)

large animals, but it is wise to keep the animal in slings. (See *Wounds of the Cord of the Hock.*) In the case of a horse, recovery has been obtained in two months by Martens, in two months and a half by Grüner.

IV.—Anterior Extensor of the Phalanges.

Rupture of this is frequently congenital. In Knoll's observation, it is a colt two days old, which had, on the right forearm, a rupture of the fleshy portion of the muscle, and on the left leg, a rupture of the tendon of the same muscle. Chassaing has often observed the same trouble in new-born subjects. The rupture may be complete or incomplete, exist on one or both legs. Generally, it takes place on a level with the knee. If complete, the patient cannot stand up; and in front of the joint two round little tumors are felt a few centimeters apart from each other; they are the ends of the tendon. In incomplete rupture, standing is almost impossible. At the post-mortem examination of several animals, Chassaing found, on a level with the carpal sheath, the tendon thinned down to half its thickness, or the two tendinous stumps completely separated. In all the cases the sheath was inflamed, and contained more or less synovia. When the rupture was complete, all forms of treatment were useless. Partial lacerations recovered by immobilization or simple friction with camphorated alcohol. In a thirteen year old horse, Gavard observed, on the left fore leg, a partial rupture of the tendon of the extensor, occurring after a mis-step of the animal. In walking the digit remained flexed on the canon, and rested for its support on the toe or the anterior face of the foot. There was great pain in front of the fetlock and a peculiar softening of that part. At the post-mortem examination the tendon was found thinned and degenerated.

Immobilization and cold to allay the inflammatory phenomena, and later blisters, are sufficient for the recovery of a healthy tendon.

V.—Flexors of the Phalanges.

The rupture of the tendons of the flexors of the phalanges is an accident quite frequent. Already in 1854, St. Cyr, in his memoirs, reported ten observations. Since then a number of others have been recorded.

Although, sometimes, as proved by the case of Rodel, rupture of this tendon may occur, when it is healthy, as a result of violent actions, it is, nevertheless, most commonly due to degenerative changes, and to softening brought on by chronic phlegmasia, rheumatism, tendinous quittor Leblanc, Saint-Cyr), synovitis (Patter), necrosis of the plantar aponeurosis from punctured wounds (Rey, Saint-Cyr), navicular disease and plantar neurotomy (Renault, Beaugnot, Mollereau). In injured horses, whose anterior quarters were supported by only one leg, Serres saw this leg be-

come the seat of a swelling, first localized on the fetlock, then spreading to the coronet, and upwards to the knee. After a while, if treatment was not applied, the fetlock would drop down, while the locomotion and special symptoms would be those of ruptured tendons; such as rest on the posterior part of the plantar surface or on the ergot, toe of the foot becoming horizontal, and inferior face of the foot perpendicular, to the ground. Upon ponies from Anam that were used by French soldiers in the extreme East, Ballu and Gillet have observed, on the hind legs especially, numerous cases of ruptures of tendons, of the suspensory liga-

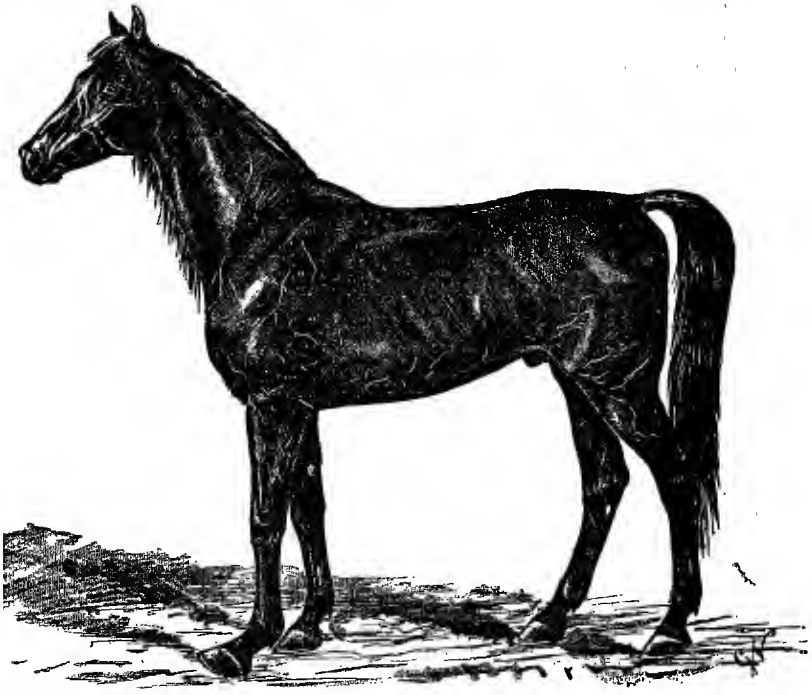


Fig. 71. Rupture of the tendons of the flexors of the phalanges. (From a photograph.)

ment, and of the sesamoid ligaments; accidents which seemed to have been prepared by a "hyperæmic" condition of these organs. In these cases, however, it is possible that they were only sudden ruptures of sound tendons, due to the enormous load carried by these little animals, or ruptures which were also promoted by the formation of their hind quarters, and the bad condition of the roads over which they traveled.[1]

[1] The trouble is quite common in America and many veterinarians have recorded cases relating to it. Among the many is that of Dr. R. Kay, where the perforans tendon and the sesamoid ligaments of three legs of a gelding were successively affected.—(Amer. Vet. Rev., vol. 8, page 234.)

The symptomatic manifestations vary in their severity, as the rupture is simple or double, complete or incomplete; when both tendons are divided, they are very marked. Most commonly the tendon gives way below the fetlock, in the fold of the coronet, and sometimes on a level with the metacarpo-phalangeal joint.

Whatever the location, complete rupture is always clearly marked by the dropping of the fetlock (fig. 71).

For horses suffering with a severe lesion of an anterior extremity so that they have only one sound fore leg for support, Serres recommended the reclining position or suspension in a sling, thus avoiding the softening of the flexor tendons. It would also be advantageous to envelop the sound leg from the foot to the knee in cold water bandage or compress.

In incomplete ruptures, difficult to diagnose (Degives), immobilization with a bandage is an important measure, and is, ordinarily, sufficient to bring on recovery.

Complete rupture is, generally, an incurable lesion demanding that the animal should be destroyed, since, in the majority of cases, extremely serious complications accompany it (chronic tendinitis, tendinous quittor, synovitis, navicular disease). In Mollereau's horse, both sesamoid sheaths were inflamed and the tendons softened; the tendinous and ligamentous apparatus of the metacarpo-phalangeal and interphalangeal joints showed marks of high inflammation with advanced softening of the tissues; the perforans was diseased from the fetlock to the semi-lunar crest; the lesions increased in severity from upwards downwards, as far as the sesamoid sheath. The tendinous tissue was, as it were, dissociated, broken up into its constituent fibres; it was purple in color, with numerous ecchymotic spots here and there on its front face and through its substance. The same lesions existed on the semi-lunar crest.

Interference is only proper in cases where the structure is not altered in accidental rupture. According to Rodet, this is not a rare occurrence on the hind legs "from violent efforts to overcome an obstacle or from a rapid gait."

The treatment then requires the application of a special apparatus or an immovable bandage to prevent the dropping backward of the fetlock. (See *Wounds of the Flexor Tendons.*)

VI.—Suspensory Ligament.

The investigations of Barrier and Poy have shown that the suspensory ligament is frequently the seat of lacerations. Therefore it is not surprising that it may be ruptured. Examples are not very rare (Goubaux). Saint-Cyr records the following:

"A horse having been harnessed to a truck loaded with stones, and the axle breaking, the animal fell down under the great weight. When it got up, it was unable to rest on its foreleg; the digital region bent forward, even when not in motion, and the animal rested with the posterior part of the fetlock down; but there was no swelling, and no local pain." The animal however, was destroyed, because it was found that the suspensory ligament was completely ruptured a little above its point of bifurcation.

In the case of Dubos, "the superior parts of the two sesamoids were broken and the separated portions remained adherent to the extremities of the suspensory ligaments."

Comeny's mare showed general manifestations of great suffering and had her front legs stretched stiffly forward. "The hind legs were brought under the body, as in laminitis; the front fetlocks could be seen dropping and rising alternately, according as each was called upon to carry the weight of the body. The rest on one leg was for a very short time and for that time the ergot touched the ground and the metacarpo-phalangeal angle measured less than 90°. In walking the symptoms were still more marked.

At the post-mortem examination, a rupture of the two branches of both suspensory ligaments was found, with lacerations of the lateral metacarpo-phalangeal ligaments, extensive secondary lesions of the sesamoid sheath, arthritis of the fetlock, periostosis and fractures of both small metacarpal bones.

Such lesions on the two front legs are incurable. With one leg only treatment may be attempted. By supporting the fetlock behind with a plaster bandage, the apparatus of Defays, or special shoeing, the tendinous ends might unite. A rest of six weeks to two months would be required.

Firing of the whole region, should it be too indurated, might complete the treatment.

V.

TENDINOUS LUXATIONS.

Those are very rare in all animal species. The horse has presented the most interesting examples. Most of them have to do with luxation of the perforatus of the hind leg; a few with that of the tendon of the posteo-spinatus.

The luxation of the perforatus, in the calcaneal portion, has been observed by Goubaux, Trélut, Burck, Drouet, Fourie, Le Calvé, Stockfleth, Gunther, Möller and Bayer.

It may take place inwards or outwards. The horse treated by Trélut

had kicked backwards violently, and, in dropping to the ground, had struck on the left hip, and nearly fallen. When he got up, it was observed that the hock was considerably flexed, nearly touching the ground. On the inner face of the tibio-tarsal joint, the hand felt a strong cord, which was easily pulled back over the point of the os calcis, allowing the hock then to resume its shape and proper position. There was no doubt that it was a luxation of the perforatus tendon. Though the reduction was simple, all means to hold it in place were useless. The author "bled the animal repeatedly to allay the inflammation and the enormous swelling of the leg." Forty days after the accident, the animal was able to resume his work as a stallion. "At the end of the season, the tarsal arch was filled with a thick cord, formed by the dislocated tendon surrounded by tissue of new formation; the animal was able to work, but the hock always remained weak." [1]

The patients of Burck, Drouet, Fourie and Le Calvé had a luxation on the outside of the hock. Instead of the motion noted in the preceding case during locomotion, the hock remained extended and the foot touched the ground. The tendinous cord was easily put back into place, but the luxation would return as soon as the hand was taken away. Burck had a leather boot made for his case, but it would not remain in place: he then blistered the hock on both sides. "The reduction took place of itself after six weeks of rest in the hospital, and the lameness disappeared." [2] Another horse recovered in the same way, without return of the trouble. Drouet says: "It seems to me rational, before using revulsive medication, to secure artificially, by a subcutaneous suture involving the bone and the tendon, the calcaneal cap of the tendon over the apex of the os calcis and then to immobilize the parts as well as possible." [3] Our colleague did not try the operation; the patient, being too old, was destroyed. In the horse of Fourie and Le Calvé, the leg was swollen from the foot to the hock. A mixture of blister and mercurial ointment was applied, followed by another a week later. Two weeks after the accident, the animal walked easier, though with difficulty. The flexion was jerky and at the time of rest all the inferior part of the leg, from the hock down, rotated from inwards outwards. The animal rested his foot on the toe and on the internal quarter.

To be more beneficial, the treatment should secure the perforatus in good position. The suture recommended by Drouet demands a delicate technic and may involve serious accidents if the asepsy is not perfect. In case it should be made, it would be necessary to relieve the hock from the carry-

[1] Trélut.—Journ. des Vet. du Midi, 1865, p. 486.
[2] Burck.—Recueil de Med. Vet., 1892, p. 341.
[3] Drouet.—Journ. de Med. Vet. 1892, p. 684.

ing weight when the animal is at rest by the use of strong splints or by the apparatus of Relier. In that region, no suture will resist the weight of the body. In the majority of cases, a blistering friction on both faces of the hock will be proper; the walking, difficult at first, will regulate itself later; after six weeks or two months, light work will be possible.

Guittard and Furlanetto have observed in cattle the displacement of the tendon of the *infra-spinatus*. To take place, such accident requires the rupture of the synovia and of the fibrous bands which hold it over the torochiter. In the patients treated by Guittard, the moving of the cord was little shown, the flexion taking place in two steps; the walking was difficult and the movements of the leg slow and hesitating. In the observation of Furlanetto, the accident had occurred on both legs after a violent effort. At rest, no symptom indicated the injury, but when the animal raised the leg, the tendon could be seen slipping backwards from the trochiterian convexity; this displacement could also be produced with pressure by the hand. Absolute rest and repeated blistering frictions were followed by recovery in a month.

VI.

SPRAINS OF TENDONS.—NERF-FÉRURE.—TENOSITIS.

Produced by powerful muscular contractions, by efforts which stretch the tendinous cords and rupture more or less a great number of their constituting fibres, this affection, observed in all animals used as motors, is very common in horses. Though a great number of tendons may be "forced," the denomination of *sprain* (*effort*) of *tendons* is applied, in ordinary language, to lesions of this kind which involve the tendons of the flexors of the phalanges, their reënforcing bands and the suspensory ligament.

The general belief, that old hippiatres did not know the true effort of tendons, is erroneous. Lafosse, in his *Dictionary*, recognizes: (1) the tendinous alterations produced by bruises (the *nerf-férure*); (2) the *extension of the tendon*, the "distension of its fibres" occurring outside of all traumatism, during the actions of locomotion. But there was an error made in relation to the frequency of the tendinous lesions resulting from traumatic causes; in most cases, indeed, the subcutaneous inflammations of the tendons of the flexors of the foot have for cause an effort, and not a bruise of the tendons.

To the expression of "nerf-férure," used then to designate the lesions which were believed to be of traumatic nature, a wider denomination has been given, which has been confirmed by use. Indeed to-day both expressions are indifferently employed.

For a long time, in classical language, "powerful and repeated efforts of locomotion" were mentioned as causes of those injuries. The mode of action of these causes has been closely studied of late by Barrier and Siedamgrotzky. With the assistance of instantaneous chromo-photographs taken in series, these authors have given a new pathology of the alterations of the disease. It is summarized as follows:

Let us suppose a leg, in which the metacarpal and phalangeal levers flex normally: at the moment when the leg in motion comes to the ground, the phalanges are in the long axis of the canon; as soon as the resting of the foot to the ground takes place, the phalangeal lever, formed by the first and second pasterns, operates a movement of flexion upon the immobile hoof, which has for effect to bring closer to each other the semi-lunar crest and the sesamoid pulley, and also to relax the perforans. A slight flexion of the first phalange also takes place on the second, contributing to the relaxation of the perforatus and of the perforans. The fetlock, no longer supported by the tendons, drops, the sesamoid pulley slides over the anterior face of the deep flexor, and at this moment the suspensory ligament is alone preventing the dropping of the fetlock backwards. If the reactions are powerful, or if the suspensory ligament is diseased, it may tear. When a slight downward motion takes place, the perforatus comes to the assistance of the suspensor; and, for Barrier and Siedamgrotzky, the lesions of the superficial flexor takes place at the first step of the rest of the foot on the ground. On the contrary, the perforans, more relaxed, is seldom lacerated. But at the time preceding the raising of the foot, when the leg is in hyperextension, the angle of the fetlock is bent forward, the phalanges become upright, the canon is oblique from forward backward, the perforans is powerfully stretched by the projecting behind of the sesamoid and glenoid pulleys, and it is the less resisting—the *reënforcing band* (*la bride*)—which generally gives way.

It is shown that, according to the new theory, the suspensory ligament and the perforatus are liable to injuries at the beginning of the period of rest of the foot, while it is the perforans and its reënforcing bands, the lateral ligament of the phalangeal joints, the digital ligaments, which are threatened at the end of the rest, when the leg ready to leave the ground is in hyperextension. Barrier has specially insisted upon the *secondary "nerf-férures."* He has shown that the false ankylosis of the first and second interphalangeal articulations predispose to the lesions of the perforans, of the carpal and tarsal bands and of the perforatus; with Petit, he has observed that the chronic great sesamoideal synovitis, in preventing the functions of the pedal pulley, brings on atrophical lesions of the perforans, well accused, and, by that alone, predisposes to the disease of the perforatus. In fact, the lesions of the carpal band occur frequently

with phalangeal periostosis, which seem to have existed before them. But the *primitive "nerf-férure"* is often observed in animals with rapid gait, whose phalangeal structure is free from lesion. In these animals, it is exclusively produced by the excessive distension of the tendinous cords under the action of the weight of the body and with the force of the impression. And if phalangeal periostosis predisposes to "nerf-férure," the latter predisposes to the former.

In a paper presented in 1844, before the Société Centrale de Médecine Vétérinaire, Prudhomme, from a number of observations gathered at the Alfort clinics, defended the statement that the carpal band was affected in two-thirds of the cases, and that the tendinous lesions were observed only in the other third. Bouley and all of his day accepted the opinion of Prudhomme. For them, the suspensory ligament was never affected, on account of its great elasticity. It was said that, when the leg returns to rest on the ground, the force, representing the weight of the body, transmitted to the summit of the os suffraginis had for result to lower the phalangeal lever; the suspensory ligament, very elastic, thanks to the muscular fibres that it contains, could yield without being injured; but the tendons, inextensible, would tear if the reactions were too powerful, and the thinner band, less resisting than the tendons, would be most frequently injured. Carefully studied observations (Barrier, Siedamgrotzky, Comény, Jacoulet, Poy) have shown that the alterations of the suspensory ligament are not as rare as they were thought to be. Indeed, the lesions of "nerf-férure" may occur in all the desmo-tendinous parts of the cannon, fetlock, and coronet—that is, upon the suspensory ligament, the perforans, perforatus, the carpal, tarsal radial and calcanean bands, the metacarpo-phalangeal sheath, the reënforcing bands sent by the suspensory ligament to the anterior extensor of the phalanges, the inferior sesamoid ligaments, the inserting branches of

Fig. 72.—Suspensory ligament, carpal band, perforans and perforatus.

the glenoid cartilage, the reënforcing aponeurosis of the perforans (fig. 72).

Which of these lesions is most frequent? We have just seen the proportion mentioned by Prudhomme. According to Siedamgrotzky, the lesions of the carpal band are far the most common. Out of eleven cases, Barrier has found five on the suspensory ligament. According to Jacoulet and Poy, this ligament would be diseased in 50 per cent. of the cases, while the carpal band would be only in 12 per cent. (Poy). The great difference between these figures is due to numerous conditions, specially to the difference of conformation and work of the animals under the observation of those authors. The professor from Dresden insisted on that point. He has shown that the lesions of the suspensor and of the inferior sesamoid were met specially in saddle, hunting or steeple-chase horses and in fast trotters. Long and weak pasterns, high heels, high heeled shoes, high action, fast gait with heavy load, misteps, jumps—all of those favor their development. Alterations of the perforans, of the carpal band, of the ligaments and bands of the fetlock and coronet are more particularly seen in heavy draught horses, exposed to violent and sudden hyperextensions. Low heels, feet improperly pared, work on uneven ground, and heavy loads predispose to them. This we observed in our clinics at Alfort among the draught horses which form the best part of our patients; as in the days of Prudhomme, lesions of the carpal band are those that we have most commonly to treat. But if the carpal band and the reënforcing aponeurosis are more commonly affected than the deep flexor, the lacerations of this tendon are not rare. According to Siedamgrotzky, they most commonly occur between the sesamoid pulley and the glenoid cartilage; they are due to the chronic inflammation of the sesamoid, carpal or tarsal sheath. Barrier, on the contrary, sees specially in those alterations of the deep flexor, atrophic and degenerating lesions, due to chronic synovitis. The frequency of the primitive lesion of the perforans is not doubtful; however, in many instances, those lesions of the perforans seem to be brought on by primary synovitis, which prevents the action of the sesamoid pulley.

Let us add, however, that all phlegmasies of the flexor tendons do not follow efforts or traumatisms. No more than others, tendinous tissue is not exempt from inflammatory process of infectious origin (pneumonia, influenza, rheumatism).

The *symptoms* of "nerf-férure" are generally well marked. At times the swelling is large, diffuse, involving the whole leg; at others it is limited to a portion of the tendon or of the carpal band; there are cases where in one day it assumes large dimensions (hemorrhage or extensive

peri-tendinous infiltration). The seat, dimensions, and condition of the levelling permit the recognition of the locality of the disease. All that is necessary is positive anatomical knowledge of the parts.

The *prognosis*, always serious and often very much so, varies with the situation, extent, and serosity of the lesions. Sprains of the suspensory ligament or of the perforatus are less serious than those of the perforans or carpal band. With complete rupture of the suspensory, recovery may be sufficiently perfect to permit the animal to resume work. When the perforans and its band are simultaneously affected, the prognosis is very serious. Distension, with or without tearing of the metacarpo-phalangeal sheath, gets well almost always; the line of the tendons remains irregular, but the lameness disappears. If both tendons are affected at the same time, recovery is doubtful. Of course, the seriousness of the prognosis varies with the severity of the lesions and the thickness of the altered fibrous structure. Again, it has been observed that sprains of the tendon occurring suddenly are often incurable, while the lameness due to a slow, gradual and progressive inflammation of the tendons ordinarily disappears by proper treatment. The prognosis is evidently aggravated when there are bony, synovial or articular lesions already present, as well as by the complications they may bring on (synovitis, periostosis, knuckling).

The new theories given upon the pathogeny of "nerf-férure" leave the prophylaxis doubtful and poor. For light legs, douches, massage and careful shoeing are recommended; thick heeled shoes are only indicated for low heels. Long bracelets in glove-skin or flannel bandages are also advisable. We must bear in mind that high heeled shoes and high heels predispose to lesions of the suspensory, and that dry roads and speed are the worst enemies of tendons.

The therapeutics of the disease includes numerous more or less active indications; but their results are uncertain; quite often, the disease resists, progresses and brings on complications. A first important indication, common to all cases, is to place the tendon in conditions which will insure it the most complete rest. To this end an appropriate shoe will be put on, and the animal turned loose in a box stall. To immobilize the cannon and the fetlock, plaster bandages have been recommended. If the inflammatory symptoms are severe, it is generally preferable to treat them by cold water, white lotions, compresses and alum water frequently changed. Ableitner advises to begin the treatment by the application of compresses as cold as possible or by irrigation; if compresses are used, they are changed for the night, by an application of wet clay alone or mixed up with salt and vinegar. Some prefer cold baths, the patient being placed in running water, three or four times a day, an hour at a time. Running

water at 7–8 deg. C. is excellent. This treatment is stopped when the local hyperthermia has subsided, occurring ordinarily after two or three weeks. The cooling method is useful, especially at the onset, where there is great pain and marked tumefaction: it reduces the phlogosis of the tendon, arrests the interstitial hemorrhages and possesses a real sedative action. We combine with it *light pressure* by the use of flannel bandages or very thin rubber roller.

At a more advanced period, the resorption of the exudate and of the extravasated blood must be stimulated. To this end, some practitioners have recourse to mercurial ointment or that of iodide of potassium; others, more numerous, use *blisters*, red ointment, mercurial blisters, strong liniments. Sometimes several frictions are made in succession and sufficiently apart so as not to irritate the skin too much. In numerous cases, after three weeks to a month, the lameness disappears. Nevertheless the tissues preserve an exaggerated sensibility: any efforts may have for result to start a new inflammation; hence a rest of several weeks is necessary after recovery. It is only by degrees and little by little that the anima can be allowed to resume work.

Most of foreign authors prefer *damp heat* and *pressure* to *blisters*. Möller recommends to wrap the leg in moist and warm wadding held in place by a flannel bandage. The dressing is to be renewed every four or five hours. This method has a remarkable action against the suffusion and paratendinous infiltrations; it prevents the secondary indurations. Ableitner, having obtained only unsatisfactory results with vesicating preparations, has given them up. After cooling applications used for a certain length of time, varying according to cases, he, like Möller, uses damp and warm compresses. The beneficial effects of this treatment, used when the inflammatory phenomena have subsided, are incontestable. Yet, blisters count also many numerous successes; they offer the advantage of being easier to apply and demand less time. The secret of success depends, however, on the long-continued rest given; it is principally when the animal resumes his work too early that the trouble returns, that the inflammation of the tendon becomes chronic and that the leg knuckles.

If cooling applications, damp heat or blisters fail, we must have recourse to *massage*, with or without hot affusions, or to *cauterization*. Recovery can be completed by massage, in covering the region with a sheet of parchment. The fingers, coated with vaseline, make light frictions on that sheet from downwards upwards in the direction of the lymphatic current; in operating methodically the massage is done without changing the direction of the hair. These applications will be made twice a day, fifteen minutes at a time, and the treatment continued for several weeks. In serious cases and when massage has given only incomplete results, cau-

terization may be used. Firing in transverse lines, penetrating points or in needles is preferred. Seldom is the superficial points cauterization, of old technic, now used.

Some practitioners begin the treatment of light lesions by moist and hot compresses. In serious cases, others use astringents first, and cold for a week; or, again, unmindful of the pain, make a vesicating friction (spirit of turpentine 100, cantharidis powder 100, euphorbium powder 100, vaseline 400), and if necessary repeat it: when the scabs are off, they cover the region with a coat of ointment of iodide of potassium and immobilize it with a plastered bandage, which is changed after ten or twelve days. If some induration of the tendon remains, they complete the resolution with hot compresses and massage.

Hunting, in the *Veterinary Record*, has on several occasions recommended the following treatment, which has given him good results: In day time, application of a pad of cotton-laine kept in place with a linen bandage; during the night, pressure with a flannel roller; besides massage and walking exercise. When the disease is chronic, a plastered bandage.

For old tendinous sprains, or those formed slowly, whose lesions become marked gradually, as well as in all cases where the local sensibility and hyperthermia are limited, cauterization had better be used at once.

When the disease is relatively recent, not subordinated to bony lesions and free from complications, good treatment gives a good proportion of successes. By his method, cold, moist heat and cauterization, Ableitner has obtained the following results: Out of 287 cases, 263 recoveries (among which a few incomplete), 24 failures. For 125 horses, recovery was obtained in one month; for 97, in about two; for 41 it required a little more than three.

A certain number of cases of tendinitis resist the most rational treatment. Either the horse remains somewhat lame or again is entirely unable to work. Then *median neurotomy* is indicated. Peters, Möller, Goldmann, Blanchard, have shown the advantages to be derived from it in old lesions of tendons, which have resisted local treatment. To perform it, the animal is cast on the lame side, the lame leg is drawn forward with a rope or carried in that position with the side-bar hobbles, and the other upper fore leg secured above the hock of the corresponding hind leg, when the region to be operated is well exposed.

Then, exploring the internal face of the elbow with the fingers, by careful motions from forward backward and *vice versa*, the thick cord formed by the median nerve is readily detected (fig. 73). Oblique downwards and backwards, it is a little more superficial than the radial artery, with

which it passes, below the elbow, under the radius and the mass of the flexors muscles.

The skin shaved and disinfected; according to the quantity of cellular tissue and the thickness of the muscular layers, an incision 4 to 6 centimeters long is made, on the course of the nerve, on a level with the inferior part of the articulation or immediately behind the superior extremity of the radius. A second stroke of the bistoury divides in the same direction and with the same length the sterno-aponeuroticus. If some hemorrhage occurs, it is stopped with affusions of boiled water or by plugging, torsion or ligatures being seldom required. The edges of the musculo-cutaneous wound kept open with spreaders, the antibrachial aponeurosis is exposed with a peculiar nacreous yellow coloration. Feeling the bottom of the wound with the finger, be sure that the nerve is situated well on the line of the incision; in the contrary case, bring it there in carrying the leg slightly forward and backward. Then the aponeurosis is divided, or,

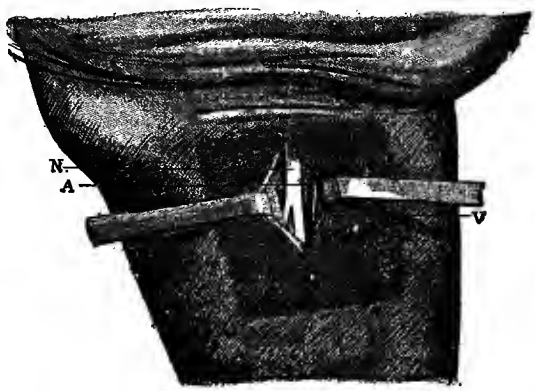


Fig. 73.—Median neurotomy.—N, Median nerve; A, radial artery; V, one of the posterior radial veins.

better still, a small incision is made through it on the lower angle of the wound, and a groove director introduced into it from downwards upwards; the bistoury, guided by the director, incises the aponeurosis from inwards outwards. This incision can be made also with a blunt bistoury. By cutting with the scissors a semi-elliptic piece of each edge of the aponeurosis (Möller) the median is more widely exposed.

The nerve is isolated by dissection of the connective tissue or by tearing it with the end of the director; the vessels and radial artery are carefully avoided. Should they be wounded, secure them with an hemostatic forceps.

The nerve being free, it is raised with forceps, an aneurism needle or a piece of thread passed first underneath it, and a piece of it (about 2 centimeters) is amputated,—the division of the nerve being made first at the upper end of the incision. The wound is then washed with boiled water; the clots of blood that it may contain are cleaned away; the edges of the wound are dusted with iodoform or covered with iodoformed vaseline, brought together with three stitches, including skin and muscle, and coated with collodion. Cicatrization may occur by first intention. If suppuration takes place, the stitches are cut off, the wound cleaned and treated antiseptically. It will be closed in about two weeks.

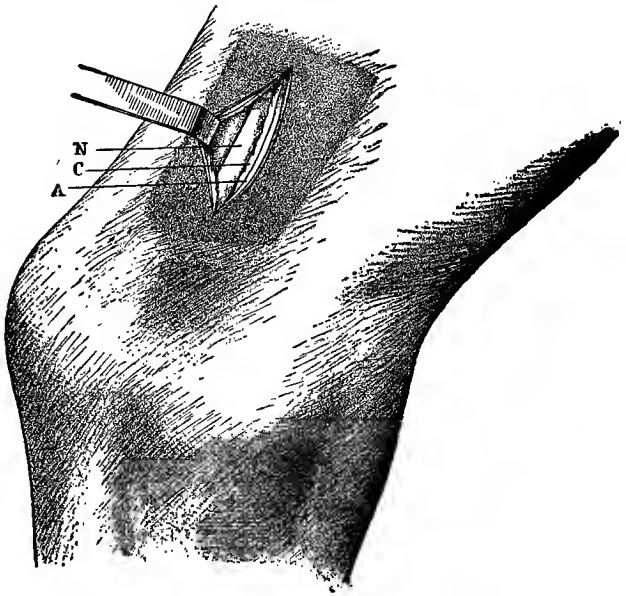


Fig. 74.—Neurotomy of the sciatic.—A, aponeurosis of the leg; C, subcutaneous cellulo-adipous layer; N, sciatic nerve.

This operation permits some animals to be used, for a variable length of time, which had remained very lame notwithstanding repeated cauterization; still the operation cannot be considered as able to render the "immense" services claimed by some enthusiasts.

Sprain of the flexor tendons is rare on the hind legs. Their treatment is the same as for those of the anterior extremity. Cool applications, moist heat, blistering or firing should be used. Should the lameness persist, and work is impossible, neurotomy of the sciatic can be used. (Rousseau, Benjamin, Möller, Vogel).

The operation is made on the inner side of the leg, a hand's-breadth above the point of the hock. The horse laid on the lame leg, the superficial leg is secured on the corresponding fore leg, and the region to be operated is thus exposed. On the selected place the great sciatic is situated almost immediately under the tibial aponeurosis (fig. 74). The skin shaved and disinfected, make, 3 centimeters in front of the tendo Achillis, an incision 4 or 5 centimeters long, parallel to it. If there is hemorrhage, stop it as usual. Divide the tibial aponeurosis in the same direction and with the same length. Möller recommends to excise a

Fig. 75.—Colt affected with knuckling on both fore legs (Möller).

semi-elliptic piece of the aponeurosis on each lip of the wound. To expose the sciatic nerve, it is good to use the groove director; once isolated, a piece of the nerve (2 centimeters) is inserted with the same care as for the neurotomy of the median. The hemorrhage stopped, the wound is washed and closed by two stitches of suture.

The cares required are those of all superficial wounds of operation: antiseptic lotions twice a day, vaseline or antiseptic powder; cicatrization is complete in two weeks. Benjamin has observed after this operation

he elongation of the tendons, the fetlock touching the ground; we have seen the same accident, and one sloughing of the hoof. Sciatic neurotomy seems more dangerous than median. This difference can be explained: the section of the sciatic above the hock removes all sensibility in the lower part of the leg, while that of the median leaves a certain amount of it, due to the cubital nerve, which co-operates to the formation of the external plantar.

VII.

KNUCKLING.

Knuckling is *congenital* or *acquired*, *essential* or *symptomatic*. It is specially common on the fore extremities. In adults, the deviation of the fetlock is either *essential*, connected with tendinous lesions, or again *symptomatic*, secondary to one of the numerous painful diseases of the anterior extremity; more particularly those of the feet or of the digital region. Young horses are subject to an essential form of knuckling, ordinarily differently marked on both legs (fig. 75).

The remarkable extensibility of tendons in colts permits the easy cure of this *knuckling of youth*. Numerous examples of it are recorded (Ehrle, Friebel, Brunet, Ostertag, Easy, Möller). When the deviation of the phalanges is not great, the cutting away of the heels, an elongated toe shoe raised at its point, will be sufficient, if the animal is turned loose in a field. If the ailment is more marked, it may be reduced with the hinged splints, by which the fetlock is pushed backwards. The orthosome of Brogniez is useful here (fig. 76).

In the *Recueil* of 1881, Brunet has described an apparatus which has given him good results. It is applied as follows: A shoe, the branches of which are elongated backwards and united by a crosspiece, is put on the shoe. From the crosspiece rises a metallic upright which carries a plate of sufficient height to reach the back of the knee in a fore leg or the chestnut of a hind leg, and about 2 centimeters in thickness. This plate, hollowed and padded, carries two leather straps, one near the superior extremity of the canon, the other a little above the fetlock; they allow regulated traction on the deviated levers and permit of them being gradually brought back in their normal position. The filly treated by Brunet was much knuckled on the left fore leg and rested on the toe; she was straight in twenty-two days (no relapse). Another was affected on the right hind leg to such extent that the entire anterior face of the wall of the foot rested on the ground, from the toe to the coronet. In five weeks the animal had recovered, and her fetlock was straight.

The application of splints and plaster dressings have also been recommended after a forced extension of the phalanges on the canon, made while the animal was secured in cubital position. Recovery has been obtained in several weeks. The dressing has to be changed at various times, as the leg resumes its proper function. Tenotomy of one or both legs is performed, if the other treatments fail. Generally the section of the perforans is sufficient.

Knuckling of adults is a common complication of tendinitis and of the

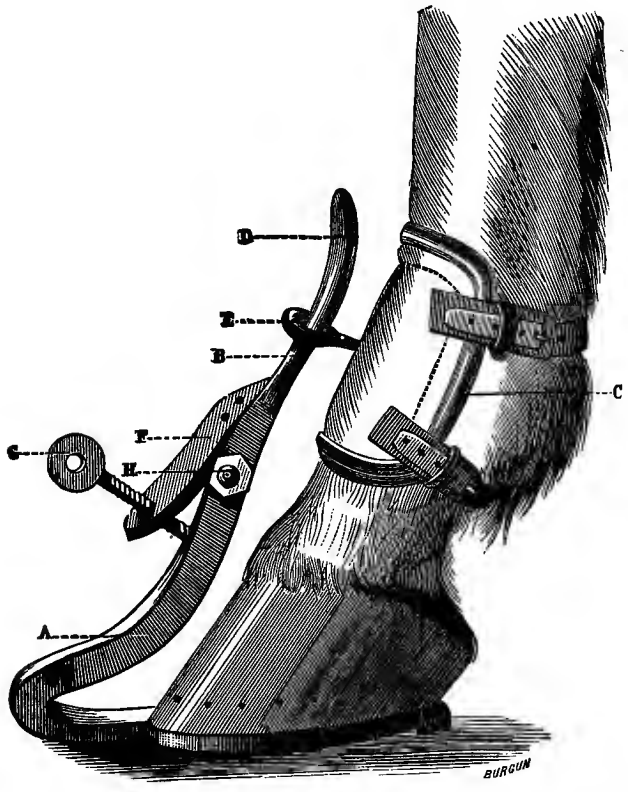


Fig. 76.—Orthosome of Brogniez (Peuch and Toussaint).

various affections met with in the inferior regions of the extremities. According to the cases, the tendons are simply retracted, or, on the contrary, inflamed and swollen. The fetlock is carried forward so much more if the lesion is serious and old. The first indication of a rational treatment consists in treating the cause: tendinitis, navicular diseases, seams, exostosis. When the retraction is slight—in cases of knuckling of

the first degree—and the actions of the animal are again free, the trouble may disappear by exercise. If already the deviation is more accused, the overtaxed bony levers become inflamed; the tendons, carrying no longer their share of the weight of the body, retract more and more, and thus, generally speaking, tenotomy must be resorted to. By turn highly recommended and again objected to severely, this operation often gives immediate and remarkable results, but quite as often the results are far from satisfactory. *Exposed* tenotomy is no longer performed. The subcutaneous method is used in our day. The animal is first shod properly. If the perforans alone is to be divided, the foot, with the heels pared away, should have a shoe with an elongated toe, so as to throw the weight of the body upon the posterior parts of the foot. In double tenotomy, to avoid the dropping of the fetlock backwards, the orthosomes of Brogniez and of Defays, or, better, the immovable bandages (Didot, Delwart), are recommended. (See *Tendinous Wounds.*)

Whether a fore or hind leg is to be operated, the animal is cast on the opposite side, the leg left in the hobble. A rope is placed round the foot, another above the knee or the hock. The skin is washed, shaved, asepsized on the middle third of the external face of the canon. Two instruments, straight and curved tenotomes, are necessary. Instead of the straight tenotome, a narrow scalpel or bistoury can be used (fig. 77.)

Fig. 77.—Knuckling and phalangeal periostosis. (From a photograph.)

Placed in front of the knee or near the hock, by careful exploration of the tendons the separation which exists between them is readily made out; when the tendons are surrounded by indurated tissue, this separation is not so readily made out. On the hind leg the middle of the canon is the spot of election, on the fore leg a trifle above it (1 or 2 centimeters.)

In the first step of the operation, the right hand, holding the straight tenotome, is thrust between the tendons until the point is felt under the

skin of the opposite side; while there slowly pull it away from the tract it has made; the curved tenotome is then introduced in its place and its sharp edge brought in contact with the perforans. Taking a point of support with the thumb on the anterior face of the canon, the section of the tendon is made by a very limited sea-saw motion of the hand, while at the moment of the division the assistants are pulling on the ropes at the foot and at the knee in different directions, that of the foot forward, the other backward. With care, the skin is seldom cut more than the point of introduction of the tenotome. If double tenotomy is performed, divide the perforans first, then pass the tenotome behind the perforatus and divide it as the perforans was. The division from forward backwards exposes a large incision of the skin; clean up the region, close the cutaneous wound with collodion and apply a slightly compressive bandage. A bloody extravasation fills up the space left between the extremities of the tendon, the surrounding connective tissue becomes inflamed and a piece of embryonic tissue is soon formed. The swelling, first warm and painful, gradually diminishes and indurates. After two months, the newly formed tissue has obtained sufficient resistance to allow resuming work. Afterwards, like all cicatricial tissue, a more or less marked retraction takes place and for a long time it is the seat of an abnormal sensibility which interferes with the motions of the animal or lames the horse.

The accidental section of one of the nerves of the canon is of no importance; wound of the artery, very rare, demands the application of a compressive bandage. More serious is the opening of the carpal, tarsal or sesamoid sacs—which can occur only with those lacking anatomical knowledge. Simple cleanliness prevents the suppuration at the traumatic center.

As remarked by Bouley, the work of cicatrization of one or the other of the tendons is always followed by their intimate and lasting union. The perforans and perforatus are solidarized, the mechanism of the ring of the perforatus is destroyed; now the phalanges, almost immobile upon each other, do not flex any more, and the horse is always liable to stumble and fall. He can no longer be utilized to fast gait, so much so that the neoformed structure remains always more vascular, more sensitive and more exposed to dilacerations than the normal fibrous tissue. However, tenotomy allows some horses to be used which otherwise would have remained unfit for work.

It is not the case, however, that successful results obtained by tenotomy remain always lasting, even where the cause of the knuckling has been properly treated. Against relapse, blistering and firing applied on the retracted cicatricial tissue have been recommended. A second tenotomy is the only thing to replace the leg in its proper position; but, from an economical point of view, it is not advisable.

VIII.

SPRUNG KNEES.

The deviation of the knee forward of the plumb-line, produced by the obliquity of the bones of the fore arm and of the canon, is most commonly the result of excessive work, an indication of wearing of an extremity: the horse suffering with it is called "sprung-kneed." Sometimes, however, the conformation is observed in young animals as a *congenital* malformation, or again occurring in the first days of life. These are called "*brassicourts*" by the French.

The treatment is indicated in animals with which this conformation is congenital or occurring during the first years of life. When it is due to overwork, to wearing, the subject is not worth intervention.

Sometimes the deformity is much marked. Brachet has related the case of a filly which, perfect at birth, was, towards the third month of her life, so severely affected on both fore legs, that both heels nearly touched the elbows; the animal was walking on her knees, almost as fast as other sound subjects of the same age. Strong pulling on the lower end of the leg was not sufficient to open the radio-metacarpal angle, so powerful was the retraction of the flexors of the canon. Other authors have mentioned similar cases. Suykerbuyck has seen an eight-day colt whose right anterior leg was sprung and knuckled to such a point that the leg was resting on the metacarpo-phalangeal joint. When the deviation is not much marked, it may be removed by proper splints. Brogniez has invented an orthosome which can be used in such cases or applied after carpal tenotomy. Solleysel and Lafosse, thinking that sprung knees were due to shortening of the coraco-radial aponeurosis, proposed its subcutaneous division. The operation has given some success (Brogniez, Chassaing), but the result is doubtful.

Retraction of the external and oblique flexors of the mecatarpus seems to be the great cause of sprung knees. Numerous authors, and among them Dieterichs, Hering, Brogniez, Bassi, Brachet, Chassaing, have published the successes they have obtained by the section of those tendons.

Miquel, on an animal sprung on both knees, cut the tendons on one leg first, and several days later on the other: the animal recovered its plumb-standing. A ten-year-old horse, not so severely affected, was operated on both legs at one sitting. The wounds were closed with pinned

sutures; cicatrization took place without suppuration; twelve days after the callus formed by the union of the tendinous stumps was as hard and as big as a French nut. From that time he had walking exercise, a month later did light work, and afterwards resumed his ordinary life, all cured.

In a filly, Brachet first made on the level of the tendons an incision (3 centimeters long) parallel to the fore arm, and divided them with a concaved bistoury. The result not being sufficiently satisfactory, he made "another section of the epicondilo metacarpal (internal flexor of the metacarpus), which prevented the complete extensions of the leg." The knee straightened almost entirely and there remained very little deviation. The separation of the ends of the tendons was about seven centimeters. The knee was placed in a padded splint held in place with a wide bandage. After a month the animal was free from pain and in one year had as good, firm action as others of her age (fig. 78).

Fig. 78.—Part of the fore arm and knee (posterior face).—Fo, oblique flexor metacarpis; Fe, external flexor metacarpis.

Like plantar tenotomy, the *suscarpal* must be performed subcutaneously. Lafosse, Gourdon, Peuch, have described the operation, which includes two steps: 1st, section of the external flexor; 2nd, that of the oblique.

The animal is thrown on the sound side; one rope is secured on the upper portion of the fore arm, and pulled backwards; another, attached to the canon or to the foot, is pulled forward.

The operator places himself in front of the knee. The region prepared, a narrow puncture is made through the skin and the subcutaneous aponeurosis, about 5 centimeters above the suscarpal bone, on the anterior border of the external flexor. Then the curved tenotome is introduced under the tendon, as far as its posterior border, and with it the tendon is divided, from forward backward, while the assistants are pulling on their ropes. The section of the oblique flexor is done in the same manner, the puncture of the skin being made on its anterior border and the division done as before.

By cutting the tendons from backwards forwards, as in plantar tenotomy, there is more danger to cut the arterial divisions situated between the perforatus and the perforans; if the operation is performed too near the knee, there is danger of injuring the articular synovial sac or the carpal bursa.

There is sometimes an abundant hemorrhage, but a simple ligature or a compressive bandage are sufficient to stop it.

According to Chassaing, the section of the tendon of the external flexor is all that is required in the majority of cases. But if the bend of the knee is great, double tenotomy is preferable.

Sometimes the straightening of the knee takes place immediately, at others it requires some time. In the cases where the knee has a tendency to bend backwards, the padded apparatus of Brachet or the orthosome of Brogniez can be used with advantage. In this way the articulation is kept in normal condition until the cicatrization is completed, and when the apparatus is removed, after about twenty days, the knee keeps the position which it has received.

When the deviation seems due to a simultaneous retraction of the flexors of the metacarpus and of those of the phalanges, it is, as suggested by Lafosse, proper to complete the suscarpal tenotomy by that of the perforans. In a twelve-days old colt, Chassaing made the section of external flexor, and a month later double plantar tenotomy. Recovery was not complete until four months after the operation.

In young dogs, it is quite frequent to observe a deformity of the anterior legs, somewhat similar to the sprung knees of horses, an exaggeration of the flexion of the metacarpals upon the fore-arm, due to the retraction of the flexor tendons. This deformity may exist in one or both legs. Generally suscarpal tenotomy succeeds. With the straight tenotome, introduced under the external and oblique flexors of the metacarpus, these are divided. Sometimes the division of the perforatus is necessary (Peuch). A dressing with splints or pasteboard, extending from the lower end of the paw to the superior extremity of the fore-arm, will keep the bones in their proper position. After five or six days, the dressing can be taken off; the wound is cicatrized. The straightening of the leg takes place gradually.

IX.

TENDINOUS HELMINTHIASIS.

The *reticulus spiroptére* is found not only in connective tissue and arterial walls, but also in tendinous and ligamentous tissues. The cervical ligament, suspensory ligament, tendons of the perforans and perforatus seem to be the most affected. When these exist on the legs, they give rise to true tendinitis with lameness (Barrier, Mauri). Ordinarily the deformity and sensibility of the affected organ permit the diagnosis; but there are cases where those are missing. The horse mentioned by Mauri was very lame on the left fore leg; the knee was constantly flexed; by

pressure of the suspensory ligament, an acute sensibility was manifested, but no deformity was visible "neither on the tendons nor on the carpal bursæ." Fine points firing applied twice did not remove the lameness. The horse was destroyed. In such cases it would be well to try deep penetrating points firing or median neurotomy.

CHAPTER V.

TENDINOUS SYNOVIAL SACS.

I.

TRAUMATIC LESIONS.

Contusions of tendinous synovials are not rare. Slight, they terminate rapidly by resolution. When they are due to violent traumatic actions, specially when the injured bursa is on the level with a distended cul de sac, a bloody extravasation may take place in the sac; or sometimes a closed synovitis may follow. Their treatment is that indicated in the chapter on contusions in general. Later, if indicated, that of acute synovitis will be prescribed.

There is great analogy between *wounds of tendinous* and those of *articular synovials:* same causes, same symptoms, same terminations. At times, one may hesitate in the diagnosis. There is a deep wound on the surface of the knee, of the hock, of the fetlock; there is escape of synovia; which sac is open? When there is no coexistence of tendinous and articular lesions, the topography of the synovials and the seat of the wound will solve the question. In doubtful cases, probing may give some light, but it is a dangerous operation. The therapeutical indications being the same in all cases, it is useless to expose a serous membrane, which may be aseptic, to infection.

The treatment of penetrating wounds of tendinous synovials has varied much with time. Antiphlogistic method (bleeding, poultices, emollient lotions of all kinds) was abandoned long ago. Cold water and astringents have been often used successfully. Arnal has treated with cold baths and astringent lotions a steer wounded above the fetlock, by the prick of a fork, which had entered the sesamoid sheath; the animal resumed work in a week, the cicatrization taking place by first intention. On a horse suffering with a punctured wound of the foot, in which the small sesamoid synovial was injured, the result was as satisfactory: the foot unshod, the sole thinned out, the wound was covered with pads kept in place with a piece of leather, and the shoe secured with four nails; the horse was placed in running water in day time, and during the night had Goulard extract lotions applied; in six days, recovery was completed. Trasbot has related a similar case: a nail had also penetrated the small sesamoid sac, the sole was thinned out, the fistula enlarged, and the wound irrigated with cold water; the 12th day, it was cicatrized.

Some authors, believing that the flowing of the synovia was the only obstacle to the cicatrization of the trauma, have had recourse to coagulating agents. Caussé and Peuch have recorded cases showing the advantages derived with tannin. Caussé says he has cured with it four cases of wounds of the sesamoid groove injured by nails and one of the synovial of the tendon of the gastrocnemius. The horse treated by Peuch was suffering with a penetrating wound of the tarsal sheath; blistering frictions on the hock and cauterization of the wound with sublimate having failed, with tannin recovery was quite rapid. Other practitioners have used successfully ægyptiacum ointment in dressings, as in cases of wounds of articular synovials.

On account of the obturating eschare that it produces, actual cauterization or potential caustics has, for a long time, been considered by some as the best treatment. Sublimate and nitrate of silver have specially been used. In the observation of Knoll, the great sesamoid sac and the articulation of the fetlock were open; sublimate, used after several other treatments had failed, brought on recovery. With sublimate collodion (15 parts in 30) Francois has obtained the rapid closing of a wound of the tarsal sac. In a horse affected with a wound of the small sesamoid sac due to a fracture of the bone, Verlinde enlarged and cleaned the wound, cauterized the fetlock with sublimate powder, and applied an antiseptic dressing. No complication occurred.

Nitrate of silver has been praised by Barthe, Dangel, Ribaud. With repeated cauterizations by this agent, synovial wounds close rapidly. The mare of Barthe, which had an open sesamoid sac after a too severe firing, recovered rapidly.

Many practitioners have combined vesicating, coagulating and cauterizing agents. The caustic tar (a tablespoonful of Norway tar, half a teaspoonful of sulphuric acid at 66°) has given Cagnat good results in the treatment of wounds of the anterior face of the knee, involving the extensor tendons and their sheaths.

Though penetrating wounds of tendinous synovials may get well by the use of so varied forms of treatment, to-day all those last, except continued irrigations, are with justice replaced by antisepsy. *Pricks*, after careful disinfection of the skin, are covered with iodoformed collodion and a wadding dressing. *More extensive wounds* should be first well washed, carefully irrigated with a strong antiseptic solution, especially if some hours have elapsed since they were received; their edges should be shaved; stitches placed at their extremities will prevent their gaping to excess; and if asepsy is sure and complete they may be entirely closed by stitches with or without drainage. A wadding iodoformed dressing insures immobilization.

II.

TRAUMATIC SYNOVITIS.

Whether *traumatic synovitis* succeeds infected synovial wounds or is consecutive to a closed synovitis ending by suppuration, its symptoms are in all cases very expressive: there is a fistula through which escapes a yellowish, clotted, more or less purulent liquid; the region is warm, painful, œdematous; lameness is great if it is the synovial of a leg; there is more or less traumatic fever. One may hesitate between synovitis and arthritis. In this last, however, the functional disturbances are more marked; the lameness greater; the swelling, more extensive and diffuse, spreading evenly on the whole periphery of the joint, while in synovitis it is limited to the side of the leg where the synovial exists, or much more marked there than on the opposite side.

According to Lafosse, synovitis would not be any more dangerous than simple peri-articular phlegmons. With the great majority of authors, we believe that suppurative inflammation of a tendinous synovial is always a serious accident. Evidently the prognosis varies with the importance of the synovial injured, the character of the wound, the length of time it has existed. In some cases, the inflammation extends to the tendon, and with a suppurative teno-synovitis, the practitioner must be modest in his opinions. Recovery is sometimes singularly favored through partitions in the synovial by septum or bands; the infection, instead of spreading in the entire serous, remains localized on one point, sometimes one of the cul de sacs. As a consequence of synovial inflammation, generally strong adhesions take place between the walls of the sac, the sliding of the tendon becomes difficult, the animal remains lame.

All the treatments indicated for synovial wounds have been recommended against traumatic synovitis. The two therapeutic methods that are favored by practitioners are *hydrotherapy* and *antisepsy*. If the former is used, sometimes the wound and surrounding region are simply irrigated with a rubber tube fixed above it; or again, by enlarging the fistula and placing a drainage tube. Through the action of cool water, purulent secretion diminishes and recovery may be obtained. We prefer, instead of cold water, antiseptic injections, following the necessary enlargement of the fistula. Sometimes a counter-opening and then a drainage. Like Mauri and Labat, we generally use sublimate 1 in 1000 in injections every two hours; by degrees the discharge diminishes, the rational symptoms improve, the wound closes rapidly. Landreau has reported a case of synovitis of the sheath of the anterior extensor of the phalanges, cured in four

days. Sometimes the suppuration is slow to stop, and recovery demands six weeks or two months to take place. Too often adhesions have taken place; the tendons do not move any longer in their sheath; there remains a marked stiffness, so much more that the suppuration has lasted longer. Massage, warm water, moderate exercise, form the base of the treatment during convalescence. When an important tendinous synovial (carpal, tarsal, great sesamoid) has been the seat of suppurative inflammation, it is rare if the region recovers the entire freedom of its motion. In such cases, to overcome the remaining induration, cauterization must be resorted to.

III.

CLOSED ACUTE SYNOVITIS.

Due to various causes (overwork, contusions, luxations, sprains, juxta-epiphysar fractures, perisynovial abscesses), simple acute synovitis offers, in its mode of development, various characters which have justified the division into a dry form (crepitant or plastic synovitis) and another with effusion (serous or purulent synovitis). On account of its superficial situation and the important part it plays during locomotion, the great sesamoid synovial is the most frequently affected.

In *crepitant synovitis*, there is no marked exudation; the congested serous, partly deprived of its endothelium, remains dry and the friction of its wall gives rise to a sort of crepitation. This variety, which sometimes is but the initial condition of the serous synovitis, has not been well studied in our animals.

Plastic synovitis begins also dry; the synovial becomes covered by a layer first embryonic, then fibrous, which creates tendinous adhesions. It occurs specially after sprains, luxations or traumatic synovitis. The tendon, more or less ankylosed in its sheath, retracts; and functional impotence or deformity of the joint are the results. When they exist in the tendons of the flexors of the phalanges, these "vagino-tendinous symphysis" promote the production of knuckling.

Serous synovitis is characterized by the exudation, on the surface of the synovial, of a reddish liquid, gathering in the cavity and distending its cul de sac.

The clinical characters of acute synovitis and anatomical data permit an easy diagnosis. The region is painful, tumefied, and little by little the serous is distended, pushed out by the fluid accumulated in it.

At the beginning, the inflammatory phenomena are treated by rest and continued irrigation or by cold compresses and repeated astringent lotions. To control the intra and perisynovial exudation, it is advantageous to apply on the compresses a band of flannel or of linen; rubber bands can also be

employed. The bandage of Delorme answers the same purpose. (See *Sprains.*)

Sedative applications are indicated if pain is great. Sedative fomentations will be advantageously employed. Generally the phlegmatic phenomena subside; but ordinarily there remains a dropsical condition of the serous with thickening of the perisynovial tissues. Hot, moist compresses, massage, elastic roller, slight exercise relieve small exudations and tendinous stiffness. When their action is insufficient, blistering and firing are resorted to. Acupuncture is preferable to the last even completed by iodurated application and pressure. If there is excessive tension of the synovial walls, *aseptic puncture* with the trocar is indicated, with or without the washing of the serous sac.

When suppuration occurs, one may, from the start, resort to phenic washing of the synovial, but if the symptoms become aggravated, it is better to freely open the sac, drain it and make antiseptic irrigations. Then the prognosis is very serious; often, if the treatment is continued, it lasts several months and recovery is incomplete.

IV.

INFECTIOUS SYNOVITIS.

In the course of some general or infectious diseases, there sometimes appear closed, acute synovitis, serous or purulent. Rheumatism, glanders, distemper, typhoid fever, purulent infection, tuberculosis, pleuro-pneumonia, dourie, variola may occur with them. In horses, they are common during or after pneumonia.

Infectious synovitis are due either to the pullulation, on the surface of the serous, of the specific micro-organisms, or to the irritating action of the toxins eliminated by the serous system. Their symptoms and march are identical to those of the closed acute synovitis, but the presence of the producing diseases guides the diagnosis. The treatment includes antiphlogistics at the start, later warm water, massage, blistering and firing. If the severity of the inflammatory symptoms makes one fear suppuration, puncture with phenicated or sublimated washing is indicated. General treatment may be useful; in presence of a rheumatismal synovitis, salicylate of soda will be prescribed.

Para or metapneumonic synovitis are peculiarly common in horses, where they have already been described as *rheumatoid synovitis*. Out of sixty-eight cases of "diseases of the chest," Palat has seen this complication five times. Bouley Jr. thought it was also common after pleurisy; to-day it is recognized that it occurs habitually with pneumonia. It is observed also in man. Chomel, Grisolle, Andral, Gintrac have seen it.

During convalescence or when the animal has recovered, lameness, at times very severe, appears from one day to the other; several members may be affected at once. According to Bouley Jr., it shows itself most commonly from fifteen to twenty days after the appearance of the thoracic trouble, and according to Trasbot from the twentieth to the twenty-fifth day. Sometimes it occurs later. Palat has observed it three months after pneumonia. It may affect tendinous or articular synovial sacs; but has a predilection for the great sesamoid—that of the fetlock.

The exploration of the lame leg allows the recognition of the diseased synovial. There is œdematous swelling, heat and pain of the region; these with the previous history render the nature of the trouble suspicious. What characterizes it essentially, is its ambulatory character, its moving from one serous to another. Trasbot has seen it affecting successively the two great anterior sesamoid sheaths, then the two posteriors and afterwards the two carpals.

Starting with the idea that the disease resulted from the accumulation in the blood of the products of disassimilation—urea, uric or hippuric acid, coloring matters, bilious salts—and of the irritating action that they would produce upon tendinous synovials, Trasbot believes that they can generally be prevented by the use of diuretics at the period of resolution of pneumonia. Evidently, the blood undergoes serious changes during the inflammation of large parenchymas, but it is hard to explain the long retention of these products and their slow action. And again it is impossible to reproduce experimentally the affection in injecting in the veins, even in larger quantity, these products of disassimilation.

Bacteriology has inquired into the nature of metapneumonic synovitis. For man, it is known to-day that it is an inflammation produced by the infectious element which gives rise to pneumonia. This pseudo-rheumatism penumonia, promoted by the single pneumococcus, is not serious; at times there is no pure pneumococcic infection; the pyogenus streptococcus is sometimes associated with the pneumococcus. (Jaccoud and Netter, Meunier.)

The preservative action of diuretics (bicarbonate of soda, nitrate of potass) is uncertain. Many practitioners have seen synovitis appear in pneumonic patients treated by diuretics, antiseptics, or by both. A good preventive treatment is yet to be found. The curative treatment includes local means and an internal medication. We have little faith in setons under the chest, as recommended by Palat. The application upon the synovial of a blistering preparation, the daily administration internally of salicylate and bicarbonate of soda, is the therapeutics which has given us the best results, salicylate specially. We give it in doses of 20 to 30 grammes a day; it may be carried to 100 and 150 grammes (Fried-

berger and Fröhner). By the combination of these means, a rapid improvement is habitually obtained; sometimes in less than 15 days the lameness disappears. If dropsy of the serous remains, firing generally removes it. That which renders the prognosis serious is the peculiar moving about character of the disease, which involves other serous. When one first lameness is relieved, and the animal is ready to resume work, another synovial may be affected and the disease reappears in it with all its acute characters. However, cases similar to that of Trasbot, where the lameness lasted eleven months, are absolutely exceptional.

If the severity of the inflammatory phenomena indicates the possibility of suppuration, aspiration followed by phenicated washing may prevent the ulceration of the synovial.

V.

CHRONIC SYNOVITIS—DROPSIES.

Common in horses, they are due to the same causes as hydarthrosis are. They sometimes follow acute inflammation of serous, or again and most frequently under the influence of excessive work. Most of the animals used for a long time to heavy work have on their legs windgalls or thoroughpins. If the accumulation of synovia in tendinous sheaths does not at first disturb the regularity of the movements, there is a moment when continually increasing it gives rise to lameness.

In the places where it is less protected, the synovial sac protrudes. The dilatations, whose seat is known for each serous, always insure the diagnosis. According to the length of time of the affection, they are soft, fluctuating, or again indurated, calcified. The ordinary clinical characters of these dropsies may be modified by the partitioning of the cavity; the dropsy is unevenly marked in the various culs de sac, sometimes even scarcely in one of them. The aspect of their fluid varies very much: often clear and serous at first, it is generally thick and dark in old dropsies. Sometimes riziform granula are found in them.

By regular training, a moderate work proportionate to the organic resistance, by douches, massage, compression, one may, in numerous instances, prevent the dropsies of tendinous synovials. When they are recent, it is again the same means that are to be used, adding to them rest in a box-stall or in the field. Purgatives and diuretics are useless. Later, when the tumors have already reached a certain size, when the perisynovial tissues are indurated, more active treatment must be resorted to: blistering, strong liniments, cantharided collodion, sublimated collodion and a mass of more or less complicated preparations can be used; but their action is less powerful and less certain than firing under any of

its various forms. If one is not familiar with the technic of the needles cauterization, he may use the method of Leblanc. The following mixed method has given excellent results: With fine points irons the skin is fired through by two or three applications, and then with a red needle, and with one stroke, the synovial sac is perforated in the half or the third of the number of points made.

For centuries, it was considered a good treatment to relieve the dropsies of tendinous synovials by allowing the escape of the excess of synovia. From time immemorial, Arabs have opened the thoroughpins of their horses with the red iron. Notwithstanding the success obtained by Bosco, this process is dangerous, when the puncture is not made with a very small point. Some authors have advised the use of the bistouri. With it specially, one must take great aseptic precautions, if he wishes to avoid the infection of the synovial; it is, after all a "synoviotomy" that must be made. Capillary puncture, *made aseptically*, is without danger; one must be careful not to make it in the few days following cauterization, when the points suppurate and the skin is infiltrated; a careful disinfection does not render the skin aseptic and the trocar may carry infectious elements in the synovial. After the puncture, the fluid often returns, but not with all the characters that it had first: the thick synovia is replaced by a clear fluid, more resorbable. Anyhow, the puncture can be repeated and completed by elastic pressure, blistering or firing.

As soon as injections of iodine were recommended in human surgery, Leblanc and Thierry tried them in animals. If they have been put aside for hydarthrosis, they are yet used in the treatment of tendinous dropsies, where they have given numerous successes. Leblanc and Thierry, who studied comparatively injections of iodine, vinous injections, and firing in penetrating points, have published the results of their observations in 1845. The solution of iodine (one part of the tincture in two of water) was injected in articular and tendinous synovials of the knee, hock, fetlock and in several mucous bursæ. The results were excellent. "We are authorized, from those facts, in saying that the injections of iodine in mucous bursæ and synovial sheaths of horses, can advantageously take the place of cauterization with the red iron, and that in the plurality of cases this medication must be used first."

Those experiments were repeated by Bouley, Rey, Lafosse, Pressecq, Verrier, Barry, Festal, Abadie, Poret, Dupont and many others. The new method gave occasion for much discussion, and notwithstanding the influence of Leblanc, it is but little used by veterinarians, who have yet great respect for synovial sacs. The rules of the use of iodine are well described by Rey. For each synovial, the place of election is the most prominent part of the tumor; it is there that it is easier to penetrate

into the cavity. A trocar, 2 or 3 millimeters in diameter, will be used, its three-faced point will penetrate through the tissues and leave an imperceptible opening which closes at once. Leblanc operated with the animal standing, but it is better to cast him. The leg to be operated on is carried in extension. After all aseptic precautions have been taken (see *Antisepsy*), the operator takes hold of the trocar with the right hand, limiting his entrance through the tissues with his fingers, and he pushes it perpendicularly to the skin, or in a slight oblique direction, by a gradual pressure with some rotatory motion. The rod removed, a jet of synovia escapes more or less abundant, according to the tense condition of the sac; sometimes, however, it is necessary to squeeze the tumor to accelerate the flow. At the clinic of Alfort we use generally the aspirator of Dieulafoy or that of Potain (figs. 79 and 80). Must the synovial be entirely emptied? Barry recommended to extract only a small quantity; he wished to reduce the effects of the iodine by mixing with the synovia; there is, however, cases where this is grumelous and escapes with difficulty; and only a portion of it is removed; but when it flows freely, as much as possible must be extracted. It is not necessary to inject a large quantity of the iodine; according to the size of the sac, from 20 to 100 grammes are sufficient. An ordinary syringe can be used, though special instruments are better. The fluid is left in the pouch for a few minutes only; gentle pressure insures the intimate contact of the irritating fluid with every point of the diseased membrane; then a second evacuation is to be made. This is sometimes difficult, even with the aspirator; clots filling up the canula of the trocar. Sometimes the greater quantity of the fluid has to

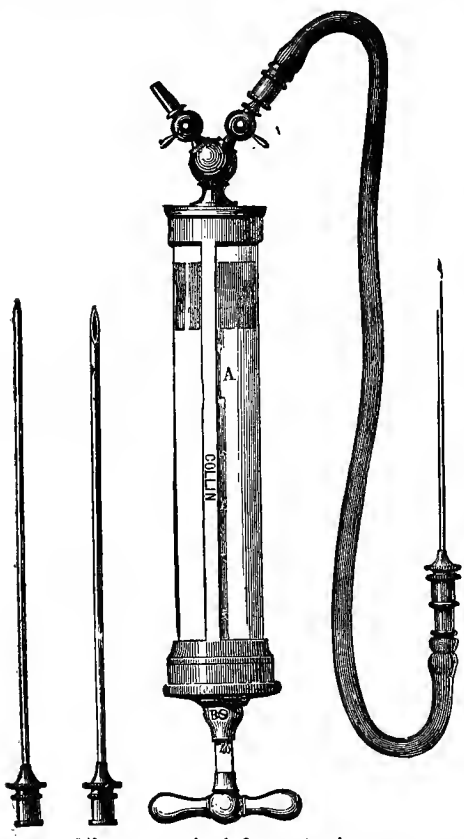


Fig. 79.—Dieulafoy's Aspirator.

be left in the cavity; notwithstanding, the subsequent phenomena have nothing alarming. In a horse affected with a large tarsal thoroughpin, we have injected 100 cubic centimeters of a solution of iodine to the third, without being able to draw out a noticeable quantity; no accident resulted from it; three months later, the tumor was considerably reduced. The operation ended, the canula is withdrawn, avoiding to pull on the skin, and the wound is closed with collodion.

The solution of iodine has been used in various degrees of concentration. In man, Bonnet has used it pure first, afterwards he employed a solution made of 16 grammes of water, 2 of iodine, 4 of iodide of potassium. Like Velpeau, Leblanc and Thierry mixed, as we said before, 1

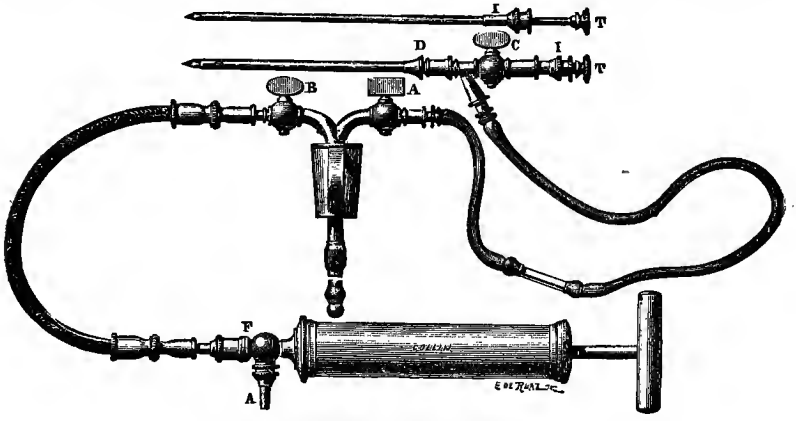


Fig. 80.—Potain's Aspirator.

part of the tincture with 2 of water. Barrier added to the tincture equal part of camphorated alcohol. We use the tincture of the Pharmacopœia, to which we add 2, 3 or 4 parts of boiled water and a small quantity of iodide of potassium to dissolve the iodine which precipitates by the mixture of the two fluids.

Though the animal shows no pain after the operation, absolute rest is indispensable. The days following, the region becomes painful and swollen; in some horses there is a high fever and great lameness; others exhibit but slight reaction. When the operation has been made aseptically, the inflammatory phenomena soon diminish. After the fourth week the animal can resume his work. The therapeutic results cannot be appreciated for several months.

How do iodined injections act? For Pérosino, they produce adhesions of the synovial walls. Bouley long ago showed this to be an error: "the serous in the parts where it is far from the center of the motion, in its diverticulums, is very vascular; there, deposits of plastic matter take place

which glue and unite the walls together by their free face, in such a way, that in the center itself, on the articular surface, on the parts of tendons which rub and slide over smooth grooves, no false membranes are formed; the freedom of motion is preserved by that of the rubbing surfaces. Irritating frictions give rise by adhesion, far from the center, to the diminution in the size of the sheaths. Besides this, they modify the general vascularity of the membrane, and hence act upon its secretion."

A high fever and severe local phenomena may demand pulverized douches or cold lotions on the region; but if the operation has been well done, no serious accident is to be feared.

The entrance of air in the synovial is without influence upon the subsequent manifestations. Complications attributed to it are the results of other causes. Many injections are made without washing of the skin, or clipping the hair; is it surprising that suppuration should occur? It has also happened that a fraction of the iodined solution has been injected in the subcutaneous tissue.

Leblanc and Thierry have made a series of thirty-five injections (15 in joints, 7 in mucous bursæ, 10 in tendinous sheaths and 2 in the pleura) without having had a single accident. Less skilful and less clean operators have had afterwards suppurative inflammation of the dropsical synovia —a complication which, in a number of cases, has ended fatally.

Tincture of iodine is not the only fluid to use; phenic acid at 3–5 p. 100; thymic acid at 5 p. 1000; sublimate 1 p. 1000 and most of the almost concentrated antiseptic solutions have been used. Chlorhydrate of morphine and ergotine have given to Laffitte excellent results. Biot has related successes obtained by the injection of blood. Stottmeister has recommended the injection of 5 to 10 centigrammes of eserine dissolved in 5 to 10 grammes of water.

When the serous is much thickened or lined with a fibrinous deposit ordinarily all those means fail. It is in those severe cases that it is advised to open the synovial.

The incision of a tendinous synovial may be done, in all species, without accidents—providing the rules of asepsy are minutely carried out. In the horse, if one has a convenient local, and is assisted by one or two assistants familiar with the work, most rigorous asepsy can be made. But, in ordinary practice, it is difficult to realize all the necessary requirements and on that account veterinarians will do well to leave the incision of synovials alone. It is, however, well known that the opening of the sheaths of the extensor tendons is far less dangerous than that of the flexors—as claimed rightly by Günther and Möller.

If we wish to make the incision, here is the manner to proceed: twenty-four to forty-eight hours before the operation, the region is dis-

infected, the hair cut short, the skin is shaved over a wide surface, its greasy secretion wiped off with ether, and then washed with Van Swieten solution, and a compress moist with the same solution kept over the region. The animal cast and the leg properly secured, the compress is removed and a new disinfection of the skin made; with an incision parallel to the long axis of the synovial, open it where it is most superficial, remove the fluid, the riziform granulations it may contain, with the finger or the curette, take off the fibrinous clots deposited on the surface of the serous, wash off the cavity with an antiseptic solution (sublimate 1 p. 1000 or phenic acid 3 p. 100), make a partial synovectomy in excising a piece of the walls, close it with silk stitches and apply a wadded dressing completed with a plastered bandage. Be careful that the horse does not bite or kick the dressing off. The progress of the trauma is indicated by the general condition. After three or four days, generally the wound is closed, but the cicatrix is not strong. It is better not to remove the dressing for a week.

With this operation, Ries has cured a chronic synovitis of the great sesamoid and one dropsy of the precarpal sheaths of the anterior extensor of the phalanges, which had both resisted other means.

Let us also mention the *drainage of the synovia*, studied in horses by Trinchera. It consists in making a small incision on the upper part of the synovial or one of its cul de sacs, in evacuating the fluid, making a counter opening on the most dependent part of the tumor, introducing a drainage tube through and irrigating the synovial with a sublimate solution 1 p. 1000. Serious inflammatory symptoms follow, which last for three or four weeks and gradually diminish as suppuration disappears. The free surface of the synovial becomes covered with granulations, but in favorable cases the walls will not unite but become covered with an endothelial layer and the freedom of the movements remains. This treatment, used until to-day only for dropsy of the synovial of the extensors of the front of the knee, hock and fetlock, might be applied to carpal and tarsal sheaths.

Special Chronic Synovitis and Dropsies.

I.—Sheath of the Biceps (Coraco-Radialis).

Sometimes the sheath alone is affected, sometimes also the tendon. In fact, most ordinarily, it is not only a simple synovial dropsy, but a *dry synovitis* or *teno-synovitis*. If the contusions of the shoulder and upper part of the arm are its ordinary causes, at times the affection is brought about by heavy trotting work, violent efforts in pulling upon uneven ground; it is quite frequent in omnibus and tramway horses (Williams).

It has been observed sometimes as accident of an infectious morbid condition, specially of rheumatism.

It is seen under two forms—an acute and a chronic state. In this last form, it may last a long time, and be accompanied with secondary lesions of the tendons and bone. In a horse treated by Villate, there was synovitis, osteitis, destruction of the bicipital groove and recent lesions of the articulation. In Goubaux's case, there were well-marked alterations of the groove and of the synovial, but the joint was free. Möller has found exostosis and partial necrosis of the humerus. Williams met with an almost complete ossification of the tendon of the biceps.

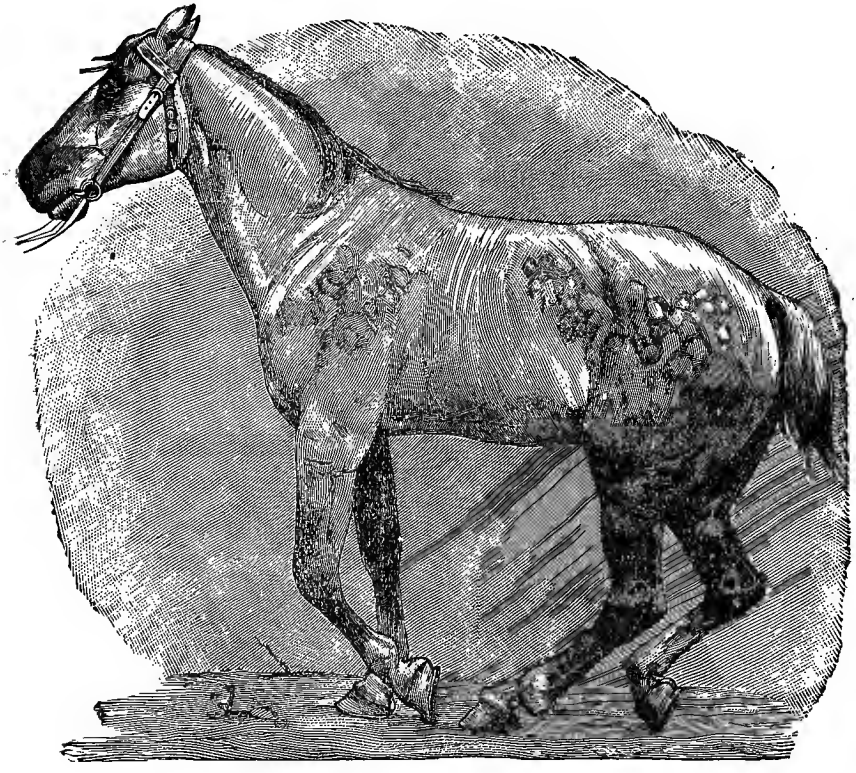


Fig. 81.—Horse affected with bicipital synovitis (Moller).

Inflammation of the sheath of the humeral biceps is indicated by very significant manifestations; at rest, the leg is held in semi-flexion, back of the plumb line; in walking, it is carried forward with difficulty, the forearm cannot flex on the arm, the foot drags more or less on the floor, the step is very short. In the observation of Villate, there were almost

no movements on the upper part of the leg, "flexion of the forearm was possible only when it was raised, and then the pain was so great that the animal pulled back and reared up." When the affection is bilateral, both legs are as if they were hobbled together, locomotion is extremely painful, the steps are short, the foot drags on the ground. Locally, more or less marked symptoms are observed and later a deformity of the region is present. At times there is a diffuse swelling, either on one or both sides of the tendon of the coraco-radialis, at times there is atrophy.

This is a serious affection. The prognosis of the acute form is based upon the severity of the symptoms; sometimes recovery is obtained in five or six weeks; in other cases it demands several months. Therefore, with Möller, we advise not to attempt the treatment on subjects of little value. Horses affected with "*chronic intertubercular synovitis*" remain always lame. They are only fit for plowing (Williams).

Absolute rest and cool applications are the therapeutics of the beginning of the disease. Continued irrigation is the best. When acute symptoms have subsided, or when they are absent, as soon as the diagnosis is made, a strong blistering friction must be made on the point of the shoulder, and renewed, if necessary, after twelve or fifteen days. When improvement is slow, lines or needle cauterization is indicated. Later, when blisters or firing have produced their effects, massage is applied twice a day on the shoulder and arm, and the animal exercised on a short walk morning and evening before he resumes his work. When the disease does not yield, the treatment is not to be kept up for too long a time except for valuable individuals.

II.—Sheath of the Sub-spinatus.

The tendon of this muscle and the bursæ which assists its gliding upon the trochiter are sometimes the seat of an inflammation produced by an excessive muscular contraction, a sprain or a bruise. The carrying of the leg in *abduction*, at rest as well as in action; more or less lameness and the local phenomena of pain and swelling, are sufficient to make the diagnosis.

For treatment, rest is often sufficient, and yet recovery may not occur for six weeks or two months. Cooling or astringent applications are indicated at first, to be followed by blistering or firing when the inflammation has sufficiently subsided.

III.—Sheaths of the Knee.

They are divided into (1) *carpal thoroughpin* or *of the flexors*, due to distention of the carpal sheath, and (2) *precarpal thoroughpin* or of the

extensors, resulting from the dropsy of the synovials which assist the sliding of the tendons of the extensors of the metacarpus and of the phalanges in front of the knee.

The first is the most important. It is ordinarily characterized by three swellings ; two superior, oblong, situated between the radius and the flexor muscles, one on the inner, the other on the outside; this last more diffused, more developed, and situated more posterioriy than that due to the dropsy of the radio-carpal articulation. The third swelling is cylindroid, and situated along the flexor tendons, in the upper half of the cannon. Dropsies of the sheaths of the extensors occupy the anterior face of the knee; elongated according to the axis of the tendons, at times bilobulated, well distinct when they are of little dimensions, they may unite together when they enlarge. Their form, their situation, deeper than that of the hygroma, establish the differential diagnosis. Anterior articular dilatations of the knee are differentiated from them by their situation and their rounded aspect, like "marbles."

Against the carpal thoroughpin, lines or fine points cauterization are used, with or without the puncture by the trocar. Iodined or phenicated injections, made aseptically, form a good treatment. The few accidents mentioned are due to errors during the operations. Blisters are not advisable, as rebel cutaneous fissures of the fold of the knee may follow. The free puncture with the cautery (Bruché) is now rightly ignored.

Dropsies of the anterior tendinous sheaths rarely produce lameness. They are treated by fine points cauterization or by irritating infections (Dupon). Puncture with bistouri (Dard) is liable to complications.

IV.—Sheath of the Large Gluteus.

This very rare affection is the result of violent contractions of the gluteal muscles, or of the stretching of the tendon when the animal, in falling, for instance, has his leg engaged under him.

The "dog-walk," body slightly curved sideways, the sound leg carried forward (Günther), the shortening of the step in the lame leg, flexion of the joints when the animal is at rest; all those are signs that do not belong exclusively to that lesion. The local signs are, as Möller says, a marked sensation of crepitation (crepitant tenosynovitis); later atrophy of the muscles; those are the true diagnostic signs.

In recent and slight cases, recovery may occur rapidly by rest and continued refrigeration. If the disease has a tendency to become chronic, or if it is already of long standing, blisters, lines or needle cauterization are indicated. When the atrophy of the muscle is marked, there remain little chances of recovery. Sometimes the inflammation of the bursæ is

complicated with periostitis of the trochanter, osteophytes develop, the parts are swollen, the lameness is excessive (Williams). Against this complication, all treatment fails.

V.—Sheaths of the Hock.

The synovials which belong to the joints of the hock, and assist in the sliding of the tendons, are often affected with dropsy. There are the *tarsal, cunean, calcanean* and the *pretarsal thoroughpin.* The latter is formed by the distension of the synovials of the extensor of the phalanges.

The *tarsal thoroughpin,* due to the dropsy of the tarsal sheath, is observed on animals which do hard work. It is characterized by three swellings having a constant situation: two, supratarsal, result from the distension of the superior cul de sacs of the synovial, in the hollow of the hock, between the tendon Achilles and the perforaus; the internal is generally more developed than the external. The third, metatarsal, surrounds the flexor tendons, in the upper third of the cannon; it forms a moniliform dilatation, not very apparent on account of the resistance of the tissues that cover it; sometimes it resembles somewhat the jarde (the curb). Tarsal thoroughpin may assume enormous dimensions. It has been seen with such proportions that, during walking, the skin which covers the internal swelling rubs and chafes against the hock of the opposite side. The diagnosis is doubtful only when both the articular and tendinous synovials communicate together.

Fig. 82.—Tarsal thoroughpin.

Cooling and astringents have been used; but the recoveries which they seemed to have given were specially due to the long rest given with them. When the thoroughpin is recent, blisters and the various liniments ought to be tried; but with old and large thoroughpins, cauterization is the classical treatment, either in lines or in deep points. In 1830 already, Dard punctured these dilatations with the straight bistouri and applied

afterwards a compressive bandage. Roettger made a free opening with the bistouri and covered the hock with a blistering preparation. These primitive modes must now give way to aseptic puncture with the trocar, which renders the action of firing more certain.

Iodined injections have been frequently used in the treatment of tarsal thoroughpin. Almost all those that have used them are unanimous in their praise. The internal growth being the largest, it is ordinarily on that side that the puncture is made, after casting the horse on the affected side; it can also be made on the outer side, the animal standing or placed in the stocks. Bouley, Barry, Rey, Knoll, Verrier, Abadie, Dupon have thus cured enormous thoroughpins that had resisted firing; we have also obtained good results with this treatment and can recommend it. But yet the operation is without danger only when it is done antiseptically. The ordinary precautions are not sufficient, as proved by the failures of Pressecq and of Verrier, who, however, operated with all the caution possible before antisepsy was known. Pressecq clipped the hair and punctured the tumor with a trocar having a silver canula; the tincture of iodine was mixed with an equal quantity of water; the operation was complicated with suppurative synovitis. Verrier used the iodine solution to the third; he also had suppurative synovitis. With strict asepsy, these accidents are not to be feared.

It is to the complication of an operation that is due the discovery of a new therapeutic process. Biot, in puncturing a tendinous thoroughpin of the hock, had a profuse hemorrhage; he had to withdraw the canula, and to close the wound with the bleeding knot used in phlebotomy; the tumor was filled with blood and thus transformed into true hematocele. The horse was left to rest for several days and then put to work; three months after the operation, the thoroughpin had entirely disappeared. A little time later, having a similar lesion to treat in a cow, this veterinarian opened the corresponding saphena vein, and after emptying the thoroughpin, filled the synovial sac with blood. Fifteen days after the operation, the tumor was hard, painless and not fluctuating. Three months later, recovery was complete. These cases of therapeutic hematocele are very interesting, but they do not seem to us free from danger. At any rate, it is better to wait for more numerous results.

Line, fine points or needle cauterizations, iodined injections when firing fails or when blemishes are to be avoided; such is, for the present, the best therapeutics of thoroughpins.

Cunean thoroughpin is the dropsy of the synovial which assists the sliding, on the inner face of the hock, of the cunean branch of the flexor metatarsi. At the place of spavins or a little above its ordinary seat, it forms a small olivary, fluctuating tumor, whose diagnosis is very easy.

This thoroughpin is without gravity. Blisterings being unsuccessful, deep cauterization must be resorted to. One may also, without fear of complication, open the sheaths with the bistouri, making an incision parallel to the cunean tendon.

The *calcanean thoroughpin*, due to the dilatation of the synovial capsula which assists the sliding of the tendon of the perforatus over that of the gastrocnemius and the apex of the os calcis, is characterized by an elongated, cylindroid tumor, extending from the summit of the hock upwards more or less along the tendon. Sometimes there are two parallel dilatations. If interference is necessary, deep cauterization and irritating injections are indicated. Incision is dangerous; if suppuration occurs, a diffused inflammation takes place and serious complications are to be feared.

As they pass on the anterior face of the hock and of the superior metatarsal region, the tendons of the extensors of the phalanges are lined with synovials, which are often the seat of dropsical conditions. According to one or both of the sacs being affected, there exists, on the antero-external face of the hock and of the superior portion of the metatarsal, one or two cylindrical dilatations, more or less soft, located alongside the tendons. These are often communicating together, and in this case the tumor is diffuse and more or less prominent. Sometimes both hocks are affected.

These thoroughpins seldom give rise to lameness; it is better to leave them alone. Irritating injections and needle cauterization are the best means to treat them. Rebel cases are treated with puncture on their lower part, drainage and antisepetic injections of the sac.

VI.—Sesamoid Sheaths.

Tendinous windgalls are formed by the distension of the *great sesamoid sheath.* They constitute above the sesamoids, along the tendons of the flexors, rounded or ovoid swelling, varying in size and consistency, rarely extending beyond the button of the small cannon bones. Situated more posteriorly than articular windgalls, they extend as high along the tendons. At times the dropsy is well marked only on one side—the windgall is *simple;* most generally, the external and internal dilatations are of the same size—windgalls are called *chévilles* (predged); sometimes, immediately above the great sesamoids they mingle on the back of the tendons and form the *circled windgalls.* Frequently there exists also in the fold of the coronet, on the lateral faces of the tendons and on each side as well as on the median line, several small dilatations.

Numerous treatments have been recommended against tendinous wind-

galls. At the beginning and in young subjects, rest, turning out to pasture or moderate exercise, astringent compresses, flannel bandages are generally sufficient. Later on, blisters, mercurial ointment, that of bichromate of potash or lines, fine points or needles firing are indicated.

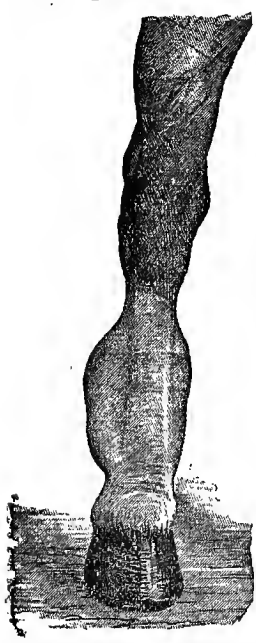


Fig. 83.—Windgall of the great sesamoid.

Dard has recommended the puncture with the bistouri (1831) and Macheras also; the latter introduced in large windgalls, a "tent of cotton." At the Alfort Clinic, Bouley and Prudhomme have resorted to puncture with blistering application. In 1844, Rey associated the puncture with the alcoholized injection, a friction of iodide of lead ointment and pressure with splints. Puncture is harmless only when performed antiseptically. It must always be followed by fine points firing or by iodined injections. Leblanc, Barry, Rey, Festal, Porel, Liard, Dupon, Reul have had success with it. The unfortunate results of Bouley, Lafosse and Verrier can be explained only by the want of complete aseptic measures.

When windgalls are old, have resisted firing and alterative injections and give rise to lameness, disabling the horse for his work, median or sciatic neurotomy may be resorted to. Möller has obtained good results with them. Some cases have been followed, after a variable time, with elongation of the flexor tendons.

If synovectomy is to be attempted, it must be only with the greatest attention to the rules of antisepsy.

To resume, recent windgalls must be treated by rest, cold compresses, massage and pressure. If they give rise to lameness, blister; in cases of failures, lines, fine points or needles firing with or without puncture; or again, intra-synovial injections with all antiseptic cares. For very old windgalls, rebel to the preceding methods, neurotomy.

Chronic synovitis of the great sesamoid is often accompanied with lesions of tendons (Barrier) or of the sesamoid bones, analogous to those of the plantar aponeurosis and small sesamoid sheath in navicular disease (Brauell, Möller, Marcher). Ordinarily in these cases, both bones are diseased; though sometimes only one. Brauell has found the flexor tendons united to the bones. According to Marcher, cauterization may give relief in those cases.

Dropsy of the *small sesamoid sheath* is rare. Its treatment is that of *navicular disease.*

VII.—Sheath of the Anterior Extensor of the Phalanges.

Formed by the dropsy of the synovial which assists the sliding of the tendon of the anterior extensor of the phalanges on the anterior face of the fetlock, this windgall, called *hygroma* by some, is manifested by a soft, fluctuating, painless tumor, clearly bilobulated by the tendon of the extensor, when it is of large size. More commou in hind than in fore legs, it is seldom accompanied with inflammatory symptoms or lameness, but it is difficult to obtain its dissolution.

Cool applications, pressure or even blistering can be used only against recent and small windgalls; at any rate, the results are only incomplete. Cauterization even is not always sufficient; often we have seen the tumor resist to numerous and closed penetrating points, yet this treatment often succeeds for windgalls of small size.

Fig. 84.—Windgall of the hind fetlock.

Simple puncture with the trocar is without effect; the tumor subsides temporarily and soon returns by a new distension of the bursæ. *Seton* run through, under the tendon, brings on recovery by suppuration of the pocket. *Free incision* acts in the same way. Rosenbaum, after having failed with several blisters, made an incision two inches long: suppuration formed, the wound cicatrized and finally the tumor grew smaller. According to Rey, *iodined injections* is the best treatment. He says "this treatment has always given us success, without leaving any apparent mark; it has specially the advantage of preventing the return of the affection." Out of some hundred horses treated at the clinics of Lyon, with iodined injections to the third, only ten failures were observed and not one complication. Sometimes, however, there was a large swelling of the fetlock and some abscesses of the subcutaneous tissue. Upon a first case treated with iodine pure, Verrier observed, for eight days, swelling and some pain; two months after there remained no indication of the trouble. In a mare with a windgall of the hind fetlock, he used the same treatment; the result was the same; the animal was laid up but a few days; two months later the tumor had disappeared. Some time after, the treatment

was again used in a windgall of the fore leg. A suppurative synovitis occurred, which lasted a long time and ended in ankylosis. Notwithstanding, the animal was able to work. Anatomy tells us that the bursæ of the anterior extensor pedis communicates with the articular synovial of the fetlock; this explains the possibility of complications similar to that of Verrier. Nevertheless, the cases of Rey tend to show that these accidents are rare, and to avoid them, one must assure himself that such communication does not exist. If it does, it is prudent to ignore the iodined injection. Strong phenic acid gives as good results as the iodine. Whatever ingredient is used, the injection must be followed by slightly compressive bandage, extending from the foot to the middle of the cannon. It is sometimes necessary to obtain recovery to resort to free opening and curetting of the pouch.

CHAPTER VI.

APONEUROSIS.

Solutions of *continuity* of the aponeurosis—wounds or ruptures—ordinarily heal without complication where care is taken to prevent infection. Aponeurotic dieresis, which are necessitated with median or sciatic neurotomy, cicatrize rapidly. Muscular hernias may take place in some regions; at times an opening, buttonhole-like, remains in the aponeurosis; at others a fibrous band attaches the muscle to the edges of the torn membrane.

The *retraction* of the aponeurosis of legs has been the object of numerous observations. Most commonly, it is due to secondary phenomena brought about by various morbid conditions. After Delafond, some authors, Eichbaum and Dieckerhoff among them, considered this retraction as the producing cause of various affections; retraction of the tibial aponeurosis gave rise to *springhalts;* that of the band of the coraco-radialis to *spring knee;* that of the reinforcing bands of the aponeurosis of the perforans plays a part in the development of *knuckling* and *clubfoot.* Some lameness of the anterior or posterior extremities, as well as some anomalies of action, are produced by the same causes. Gavard has related the observation of a mare that was very lame and which was cured by the subcutaneous section of the aponeurosis of the fascia lata. One morning, this animal, which had already had several slight attacks of lameness, was found unable to move; "the right leg, stiff as an iron bar, did not rest on the ground; . . . it is impossible to move the leg or any part of it, and the manipulations made to that effect are very painful to the animal." In front of the thigh was observed a wide ribbaneous band, stretched to excess, and above the stifle there was a painless, soft effusion. This band was divided transversely in about its middle, the animal standing. "Immediately, the animal recovered the freedom of his movements; he walked without difficulty." [1]

On account of their inextensibility and great resistance, aponeurosis often give a peculiar aspect to the inflammation existing in the tissues that they cover. Preventing their development, they give rise to violent pain, interfere with the circulation and produce an ischemical condition which, if continued, promotes gangrenous accidents. When suppuration occurs

[1] Gavard, Journ. de Med. Vet., 1893, page 584.

in those tissues, pressure by the aponeurosis ordinarily makes the pus migrate alongside the connective layers, until it finds a place for escape; sometimes aponeurosis are perforated by the necrotic fluid; then, almost always the opening of communication of the sub and susaponeurotic infiltrations is very small and it becomes necessary to make a free incision or a counter opening. The incision of aponeurosis is made as much as possible from inward outwards, with the bistouri guided with the grooved director, bearing in mind the presence of blood vessels and nerves. Sometimes the operation is not without danger; the tissues being indurated, the instrument must be introduced deep. In the region of the flank, the peritoneum is not the only danger; Blanc, in operating on a horse, had a mortal hemorrhage.[1]

Submitted to the long action of pus or injured by a soiled wounding object, the closed, little vascular tissue resists badly against infection; often a more or less extensive part of it becomes mortified, and once established in the aponeurotic structure, necrosis spreads little by little, as it does in tendinous tissue, in the scutiform plate, giving rise sometimes to very severe disorders, to numerous fistulas and abundant suppuration. This march is that of most necrosis affecting the aponeurosis of the withers, the back, croup, flank or lower abdominal wall. In a horse affected with necrosis of the aponeurosis of the flank, following a puncture of the cæcum, we had to make three successive counter openings, the last one far away to the inferior part of the abdomen, and notwithstanding a most careful treatment, recovery did not take place for four months. The indications for all those necrosis are the same; free incisions or counter openings, introduction of tents or drains to insure the flow of pus, repeated injections of strong antiseptic solutions (phenic acid, creoline, chloride of zinc, Villate solution, tincture of iodine).

[1] **Blanc,** Bullet. Soc. Med. Vet. Prat., 1895, page 45.

CHAPTER VII.

ARTERIES.

I.

WOUNDS.

In general, arterial wounds exist in connection with solution of continuity of the tegument; this condition is sometimes missing, as in the case of wounds made by swallowed foreign bodies; those may reach the aorta and in their migrations through the tissues injure large arterial or venous vessels. If the lesion is very small, there is no hemorrhage; the anatomical elements, separated for one instant, retract after the passage of the wounding body; repair takes place by first intention. More commonly there is hemorrhage; at times—specially if the artery deeply situated communicates with the exterior by only a narrow tract—the hemostasis takes place rapidly by the formation of a thrombus, "wedge-like," which separates the external coat in the surrounding of the opening, depresses slightly the internal membranes and obliterates the wound. Circulation goes on in the wounded blood vessel; a consecutive aneurism is exceptional in animals. (Renault.)

The carotid or the saphena are the vessels which, in most of the observations of *arterial punctures*, are spoken of (during phlebotomy); in a few it is the aorta or one of its divisions. In performing puncture of the vagina in ovariotomy, if the point of the bistouri reaches one of the large arteries of the pelvis, the blood escapes in the peritoneum; no pressure being applied on the vessel, death occurs in a few minutes. With a therapeutical object, punctures of arteries have sometimes been performed (acupuncture, electro puncture); but in these operations the point remains a certain time in the interior of the vessel and insures the obliteration. The experiments of Velpeau have demonstrated the coagulating action of foreign bodies.

Wounds with sharp instruments are *penetrating* or *non-penetrating*. The latter are not serious; whether they run through the sheath only or extend to the middle coat, they seldom, in animals, expose them to the formation of aneurisms.

Penetrating wounds divide the vessel completely or incompletely. Large arteries entirely divided by a transverse section give rise to such abundant

hemorrhage that death occurs before any repairing work can be started. In arteries of medium size, deeply situated and communicating externally by only a narrow orifice, hemostasis may take place naturally. In such cases, both extremities of the divided artery retract in their cavity as would the ends of a stretched elastic tube, when divided; the open mouths of the vessel shrink, the blood infiltrates in the sheath and the surrounding tissues; an *external clot* is formed first, then coagulation spreads to the interior of the arterial ends and gives rise to an *internal clot*, more or less elongated, generally extending to the first collateral. To insure complete hemostasis, this clot must organize. From the arterial wall and the edges of the wound, true vegetating endarteritis is started, whose granulations penetrate the structure of the clot and transform it into a fibrous tissue which in time retracts: to such an extent that after a certain time the divided extremities represent only fibrous cords, united together by a tractus of similar nature. All danger of hemorrhage is removed as soon as the clot is sufficiently organized; but at the beginning, when it is still fibrinous, an external violence, a strong rush of bloody current, a somewhat active inflammation of the coats of the vessel, are sufficient to bring on a new hemorrhage, whose serious nature will be proportional to the importance of the vessel.

Spontaneous hemostasis takes place so much more rapidly that the animal's blood is "more plastic." In relation to this, dogs occupy the first place; then come cattle, sheep, and, far behind, the horse. In dogs, the transverse section of the carotid is not always fatal. Surgical practice shows that "hemorrhages due to transverse sections of large muscular arteries, as in those of the neck, of the withers, chest and croup in horses, either stop spontaneously or are easily controlled by hemostatic means of secondary powerful influence." (Bouley.)

Fig. 85.

Fig. 86.

Fig. 87.

Wounds of the Arteries.

Incomplete sections are *transverse*, *oblique* or *longitudinal*. In almost all, spontaneous hemostasis is possible. If the wound, *transverse* or *oblique*, is narrow, the phenomena are similar to those of punctures. An

hemostatic wedge, with base outwards, whose point is between the two edges of the wound, stops the flow of blood. In a large wound, involving more than half the circumference of the vessel, the edges gape apart by the retraction of the elastic fibers; the wound assumes an oblong form which favors the hemorrhage—the divided ends no longer able to retract in the depth of the tissues, the constant push of the bloody current prevents the formation of an obliterating clot. *Longitudinal* wounds are the less dangerous. There is no marked separation of the edges; repair goes on as in pricks or in punctures.

In *contused wounds*, arteries may be divided cleanly, as in wounds with sharp instruments. Sometimes the internal and middle coats rupture first; the external favor the hemostasis by its stretching. *Projectiles* give rise to lateral wounds, perforations or complete divisions. In the *tearing* of arteries, the coats of the vessel stretch, then the internal tears first; if the stretching continues, the middle coat then gives away and then comes the external. When the artery is of small size, there is no escape of blood: the inside and middle coats are covered by the external, which has stretched much before giving away; the tearing completed, both ends of the artery retract, especially the middle coat, and the external membrane, less elastic, covering the two stumps of the vessels constitute a kind of cork which arrests the blood; an effect similar to that produced in torsion or section with the ecraseur.

A widely open arterial wound is always characterized by a rutilant hemorrage whose force of current is so much more marked that the vessel is nearer to the heart; the beatings of this organ being manifested upon the flow of blood by jerks isochronous to the ventricular contractions. When the external wound is narrow and sinuous, the fluid runs out yet freely, but it is not pushed out so far. With the exception of wounds by tearing, arterial divisions are always accompanied by an hemorrhage called *primitive*. When arrested spontaneously or by treatment applied against it, sometimes the flow of blood reappears after a few days, either through the exploration of the wound or softening and disaggregation of the clot; this hemorrhage is called *secondary*.

To arrest the flow of blood, such is the only indication of arterial wounds. For a long time old surgery depended on the use of astringents, styptics, cooling preparations. Cold water and ice have never arrested a serious arterial hemorrhage, and even the classic chloride of iron does not deserve the reputation made for it in veterinary surgery: it promotes the formation of a clot where infectious germs pullulate, and if, after its use, the surgeon wants to secure the strings of the blood vessels, they are very difficult to find. For hemorrhages in sheet, cautery is the best. If the lesion is on a leg, a temporary hemostatsis may be made with digital

pressure or the tourniquet. Permanent hemostasis is obtained by antiseptic plugging, torsion, ligature or forcipressure.

Compression in the wound demands minute asepsy. In legs, the wound, made bloodless by the use of the tourniquet or ligature en masse of the region, should be plugged with iodoformed gauze or antiseptic wadding. A wadding dressing will complete the operation. After five, six or eight days, under the gauze, softened with tepid water and removed with care, will be found a dry, granulating surface; the after cares are the simplest.

With *forceps* for *forcipressure*, it is generally easy to secure the ends of the divided vessel. If ligature appears difficult, if the instrument is well aseptic, it can be left in the wound and enveloped in the dressing. It is removed after forty-eight hours.

Torsion, defended of late by Tillaux, deserves to be used for small arteries. With the forceps, the arterial stumps are twisted; the internal and middle coats shrink, the remaining external covers the extremities and stops the blood. (Figs. 88 and 89.)

Fig. 88.

Fig. 89.

Torsion of the arteries. (Tillaux.)

Ligature is the most certain of all means. Large vessels must be tied at both ends. With a complete section, the extremities are retracted in the interior of the tissues; one must not hesitate in cutting those to expose them. As ligature, catgut or silk is used; the essential is that it should be aseptic. Catgut is resorbed, silk incysts, and the tissues tolerate it without reaction. Ordinarily, the ligature of the central end is not sufficient; even when the peripheral end seems to be bloodless, it must be looked for and secured, as the small clot that obliterates it would not resist collateral circulation; secondary hemorrhage might occur.

The effects of ligature of arteries are known: the internal and middle coats break and retract; the blood coagulates in variable extent in both stumps; after a few days the strangulated external coat gives way. The endarteritis promotes an active cellular neoformation, filled with capillaries starting from the walls of the vessel; the organization of the clot brings a lasting hemostasis.

To supply the circulation of the ischemied surrounding, collateral blood vessels develop and prevent gangrene of the tissues formerly irrigated by the now obliterated blood-vessel.

With simple arterial puncture, one may often dispense with the ligature;

pressure is sufficient. When a large bloody tumor is formed, pressure of the vessel toward the central end has been recommended: it can be used for some arteries. If, however, the enlargement continues so as to endanger the conservation of the tegument, it is better to cut freely and ligate the two divided ends of the vessel. Puncture of the carotid in the horse has for a long time been considered a serious accident. But the observations related by Favre, Bareyre, Delafond, Rainard, Cabaroc, Rey, Mangin, Dayot, Prangé, Roux, have shown that generally the hemorrhage can be controlled by the application of one or two pins on the wound of phlebotomy, in taking hold of a sufficient quantity of skin and making on the surface of the tumor a permanent pressure, with the aid of pads of oakum soaked in cold water and held in place by splints and bandages. The blood filtrates more or less abundantly in the jugular groove; a diffuse aneurismal hematoma is formed, which disappears ordinarily in eight days; sometimes this is enormous, and then pressing upon the trachea brings on death by asphyxia (Rainard, Loucou). In the observation of Van Autgarden, the roaring was such that the author had to perform tracheotomy. These are exceptional cases. Ordinarily the resolution of the tumor goes on little by little, the arterial wound cicatrizes, the current of blood is preserved; a secondary aneurism seldom follows. Noquet has observed a case of this kind in a cow where the saphena artery had been pricked during bleeding at the vein; hemorrhage had stopped after the closing of the wound with two pins; there was a thrombus as big as an egg. A month later, the tumor had the same dimensions; it was punctured, an abundant quantity of blood escaped; a new suture was applied, the pins sloughed out, which was followed by a mortal hemorrhage.

Ligature of the carotid has been recommended by Montier, Segretain and others. Quite delicate, it is not without danger of complications. One must not resort to it unless the hemorrhage is very abundant or if the extravasation, voluminous, interferes seriously with respiration.[1]

II.

RUPTURES.

Ruptures or *subcutaneous tearings* of arteries have for ordinary causes traumatisms, comminuted fractures, luxation, muscular efforts, vomiting, the action of veratrine (Hering), and certain manipulations of the surgeon

[1] J. E. Brown has related the case of a three months colt which was horned by a Jersey bull and which had received a lacerated, contused wound with division of the carotid artery, jugular vein and pneumogastric nerve. Ten inches of the artery was left hanging to the wound, with ten or twelve inches of the nerve and five of the vein. The artery was ligated, the protruding ends of the artery and nerve were cut off. Recovery was perfect.—American Vet. Review, vol. xv., page 279.

to reduce fractures and dislocations. Embolics may also soften arterial coats and promote rupture (Cadéac). In the great majority of cases, alteration of the vascular walls (atheroma, aneurisms) has been observed on a level with the rupture. Some cases, however, prove the possibility of rupture of vessels whose walls present no lesion of degeneration. When it occurs in a superficial artery, a diffuse, warm tumor forms at once, irregular and pulsating as aneurisms do, though not so powerfully; seldom can the bellow murmur be detected in them. This bloody effusion, called *diffused or false aneurism*, is not an aneurism. The name of *diffuse aneurismal hematoma*, proposed by Michaux, is to be preferred.

The large arteries of the thorax and abdomen rupture more frequently than superficial vessels. Sometimes it is the pulmonary artery (Hering, Hartmann, Prietsch). At the post-mortem of a dog, that had died suddenly, we found a large distension of the pericardium by blood extravasated through two little tears situated on the right face of the pulmonary artery. In the zone where the tears were, the artery was very thin and presented several small transparent spots. But, no doubt, it is the aorta which is injured in the greater number of cases. Larcher has reported twelve observations at the *Société Centrale de Médecine Vétérinaire* (1876). In all, the tears had taken place at the base of the primitive aorta, at a point where the vessel is still covered by the pericardium; this contained a noticeable quantity of blood, sometimes fluid, more generally coagulated. In five cases the structure of the vessel was the seat of atheromatous degeneration; in two, no visible alteration could be detected; in five others, no mention is made of the condition. To these twelve observations of Larcher, we might add those of Vatel, Maillet, Rigollat, Palat and others published in other countries or recorded by us at the Alfort clinics. In horses, rupture of the aorta is not rare.

If, generally, the diagnosis is only positive at the time of post-mortem, the accident can be suspected, taking into consideration the circumstances in which it takes place and the symptoms it gives rise to. The symptoms are those of large internal hemorrhages. "In one case, a high jumper, after a prodigious jump, suddenly drops on his hind quarters, to rise no more. In another, the horse, as he is cast on the bed to be submitted to an operation, makes a powerful inspiration, his eyes roll in their orbits, the respiration and beatings of the heart stop and immediately he is pulseless." (Larcher). In two cases that we have seen, the rupture took place during the struggling of the animal while lying on a bed for operation. The aorta may give way at a point some distance from the heart. At the autopsy of a twelve year old mare, that died suddenly in stocks, we have found a rupture of the aorta on its superior face, on a level with a small exostosis of the third lumbar vertebræ. The vessel had two ulcerations; the

smallest like the scratch of a nail, having sharp, ragged and sinuous edges; it occupied the entire thickness of the wall; its bottom seemed formed by a fine transparent anhistous membrane. The other, situated like the preceding on the dorsal face of the vessel, presented the same external characters; the tear started from its bottom.

Rupture of the pulmonary artery, primitive aorta or one of its divisions, ordinarily kills in a few minutes; all attempt at interference is useless. With those of secondary and superficial arterial trunks, treatment may be efficacious. *Pressure* on the vessel, on the cardiac end, may sometimes arrest the hemorrhage, specially if with it cold effusions and astringents are used. The application of a compressive bandage may also give good results. If, notwithstanding these, the blood continues to accumulate under the skin, the ends of the ruptured vessel must be looked for and secured with ligature.

To rupture of blood vessels can be added the perforation of their coats by nemathelmintes which they may contain. This accident has been observed in horses with the sclerostomus armatus (Durieux) and in the dog by the sanguineous spiropterus (Morgagni, Degive, Megnin.)[1]

III.

ANEURISMS.

According to the form of the arterial dilatation, *aneurisms* are divided into *fusiform*, when they occupy the whole diameter of the vessel, and *sacciform*, when limited to a portion of the wall only. Their origin is *primitive* or *spontaneous*. A bruise may divide the internal membranes of an artery and create a *locus minoris resistensiæ*, where the traumatic aneurism takes place. Acute or chronic inflammation of blood vessels, atheroma, promote the formation of spontaneous aneurisms. Endarteritis is often due to parasites (strongyli, spiroptera). In the majority of horses, the great mesenteric, and at times the small and the cæliac axis are the seat of aneurismal lesions due to the *strongylus armatus*. Very severe colics (intestinal congestion, thrombo-embolic colics) seem to be the result of an infection starting from these points. Megnin has described in the dog two cases of aneurisms of the aorta due to the *sanguinolenta spiroptera*.

[1] A case of rupture of the internal iliac is reported by W. J. Martin occurring in a mare during the manipulations made by the owner to relieve her in a case of distokia. The mare had received a small dose of chloroform to quiet her pains but died as her colt was removed. At the postmortem the rupture of the artery was found just below the junction where it leaves the posterior aorta.—American Vet. Review, vol. xxiii, page 114.

Aneurisms constitute a prominent danger. Wounded, they give rise to an abundant hemorrhage; their rupture is generally fatal. Internal aneurisms are beyond surgical interference; the external only are justifiable of an active treatment; they are rare in animals. They have, however, been observed in horses on the *palatine artery*, the *pharyngeal, internal maxillary, gluteal*, on various arteries of the legs; in cattle, on the *vertebral, ischiatic* and the *tibial*. The observations of Blaise, Steinmeyer, Walley, refer to horses that have died from rupture of aneurisms of the pharyngeal, carotid and internal maxillary arteries.

When, upon the course of an artery, one observes a tumor evenly fluctuating, depressible, reductile, pulsating, he must think of aneurisms. Sometimes they are mistaken with neoplasm developed on the tract of a vessel. Möller has told us that he made an error of this kind and took a carcinoma of the neck for an aneurism. A puncture improperly made may be followed by the most serious sequelæ; as the case of King related by Percivall in his *Hippopathology:* An old horse had on the croup a tumor of the size of a man's head; it was fluctuating. King punctured it; a flow of blood took place at once; plugging was vainly tried, the animal dying. Dissection revealed the presence of an aneurism, partly ossified, of the gluteal artery.

In the case of the cow recorded by Collin, she had on the left side of the neck a soft, elastic tumor, as big as the fist, well defined, not adherent to the skin, without heat or pain. Mistaking it for a cyst, the author tapped it with a pointed red iron, which was immediately followed by a flow of rutilant blood, jerky, as big as the finger. A continued suture arrested the hemorrhage; but the blood escaping in the subcutaneous cellular tissue, the tumor became treble in size, and the arterial beatings were readily perceptible. The treatment consisted of cold lotions. The size of the tumor diminished. All danger seemed avoided, when the animal rubbed herself against a tree, and serious hemorrhage followed. The animal was sold to the butcher and destroyed. She had an aneurism of the cervical artery.

Spontaneous recovery of aneurisms is possible; it takes place by thrombosis; a clot is formed in the sac and closes it. The artery may keep its caliber or obliterate. Such termination is rare; ordinarily aneurisms assume larger and larger dimensions, disturb the surrounding tissues and their possible rupture is a constant danger to the life of the patient. Furlanetto thought best not to interfere in two cases of aneurisms, quite large, of the tibial artery in steers. Both animals were able to continue their work.

Various methods oft reatment have been recommended against aneurisims. General depression by bleeding, low diet and purgatives (method

of Valsalva) is now left aside. Digital or elastic pressure (method of Reid) is not practicable in veterinary surgery on account of the restlessness of our patients. Coagulating agents, so much in favor in days gone by, are now ignored. Ligature and extirpation are now the only modes of treatment resorted to by surgeons.

Ligature may be applied above or below the sac, or on both at once; the operation is simple. Aseptic catgut or silk is used. The ligature above the sac (method of Anel-Hunter) has many advocates. As soon as it is made, the tumor flags down, the murmur, pulsation, and expansive movements cease; the region becomes cold. The circulation through the collaterals is generally sufficient to prevent the gangrene of the region where the ligated vessel carried the blood; still there is a possibility of this dangerous complication. A clot closes the sac. Under the influence of the collateral circulation, the blood reappears in the tissues, in the sac itself, and the passive clot is transformed into an active clot. The recovery thus requires: "(1) the temporary arrest of the circulation and the formation of passive clots; (2) the graded return of the circulation, allowing the transformation of the passive fibrino-globular clots into active fibrinous." (Michaux.)

Double ligature, above or below the dilatation, is used as much as the preceding. In the horse, La Motte has cured with it an aneurism as big as a chicken's egg, situated on the poll, behind the ear, and developed on the posterior cervical artery. In a similar case, Peters has also been successful with the same treatment.

Extirpation of the sac between two ligatures is considered by some surgeons (Trélat, Delbet) as the choice mode of operation. It is more complicated and requires more division of tissues than ligature, but it is radical in its effects; it removes the possibility of return and does not expose to the suppuration of the sac.

One may be called to treat a hemorrhage due to the opening of an aenurism. Reimers had a similar accident in a steer which had a tumor on the croup; the bleeding was stopped by plugging and perchloride of iron. In some cases, interference must be applied as quick as possible. Plugging, iodoformed gauze, double ligature or extirpation are indicated.

ARTERIO-VENOUS ANEURISMS.

In these, there is an accidental or spontaneous communication between an artery and a vein. Traumatisms are generally the cause. It has occurred in man quite often by bleeding with the lancet. The arterial blood, with its pulsating force, enters into the vein and distends it. A soft tumor is formed, whose characteristic symptom is the vibrating trem-

bling, the *thrill* of English authors. "This peculiar trembling is observed and also heard as well as it is felt by the touch; it is composed of a sound and a vibration. This sound and vibration are continued and are increased in connection with the cardiac systole; they are perceived especially at the level of the tumor, where they are greatest, but they can be detected at some distance from it. . . . The sound of this thrill has been compared to the buzzing of a bee, the purring of a cat, the whizzing of a top, of a mill, to the noise of the red iron dipped into water. . . . The vibration is so characteristic that, felt once, its character and nature are never forgotten." (Michaux.)

Cagny has described an arterio-venous mesenteric aneurism. The cases of Chauveau, Collin, Nocard, Moreau, are interesting. In the first, it was a tumor, as big as an egg, situated along the course of right maxillo-muscular artery and vein, outside and a little back of the inferior jaw. This tumor, easily reductile, would return as soon as pressure ceased; the hand felt in it a very strong pulsation, isochronous to the systole of the heart; the vibrating thrill was readily perceived. At the post mortem, the tumor was found to exist on the tract of the vein and communicated with the artery; it measured eight centimeters in length and about four in width. Both vessels were dilated at the seat of the aneurism.[1]

The case of Collin relates to a young steer, castrated ten months before by a gelder. Both cords had been twisted and then torn. The animal presented in the scrotal region, a tumor, egg-like, indolent, very soft and elastic. "In pressing it gently, one could feel the beatings corresponding to the cardiac systoles; to which succeeded without interruption, well marked and characteristic vibrating thrills." When the subject was killed, at three years old (thirty-two months after castration), the tumor measured from fifteen to twenty centimeters in height and about thirty in circumference. The dissection, made by Lesbre, showed that it was produced by the great testicular vein and artery enormously dilated, elongated and communicating together.

In a fifteen year old gelding, Nocard found a soft, elastic tumor, as big as the fist, occupying the left side of the sheath, some centimeters back from its anterior opening. It was the seat of beats isochronous to the arterial pulsations, and each of these was followed by a series of vibrat-

[1] In the case of H. D. Hanson of a horse that had died during an attack of colics, he found at post mortem: "a large growth of the size of a cabbage head, of hard consistency, situated in the lumbar regions towards the base of the cæcum, which on being removed proved to contain a large abscess in its center communicating with the ileocæcal artery and involving the right fasciculus of the great mesentery." —Amer. Vet. Review, vol. xix., page 706.

ing thrills. The external pudic artery communicated with a large venous division of the sheath.

In subjects of the bovine species, Moreau has seen two arterio-venous aneurisms of the face developed on the course of the facial artery and vein. In one, there was also exophthalmy, due to the dilatation of the ophthalmic veins.

Where surgical interference is decided upon, bloody manipulation, with strict antisepsy, forms the proper treatment. The double ligature of the artery above and below the sac must be applied on the aneurismal varix. In all the other cases, both ends of the artery and of the vein must be ligated (Delbet). If the sac is large, ligature must be followed by extirpation (Trelat). In cattle, Gurlt, Prinz, Meyer, have treated by excision the arterio-venous aneurism of the great testicular without any accident following.

IV.

ARTERITIS AND THROMBOSIS.

Any inflammation existing in the tissues surrounding an artery, may spread on it and give rise to serious lesions. Some arteritis are embolical in their nature; others start in the course of infectious diseases, progress quietly and become manifest only much later on, by functional disturbances due to secondary thrombosis.

Obliterations or arterial thrombosis deserve a special study on account of their peculiar symptoms. Assisted by the diminution of the circulatory current (Virchow), the principal part in their formation is due to arteritis and embolies. The clot may be parietal, incompletely close the caliber of the vessel and diminish the circulation; but it may also prevent it entirely. At first very thin, this clot generally develops in the direction of the circulatory current as far as the first collateral; it gradually increases in size; sometimes the vessel which contains it is bosselated. Its color is yellowish or reddish, its consistency more or less firm; it seems formed by layers successively deposited upon a primary nucleus. The muscles which receive blood from thrombosed vessels present no important alteration; yet Bouley Jr. has found them "pale, discolored, and less consistent than in normal state."

Besides traumatic thrombosis, arterial obliterations are frequently found in horses; their pathogeny is yet uncertain. Thrombosis of the posterior aorta is most common. Some authors, Goubaux among them, have accused the laceration of the walls of the aorta, produced at a moment when the animal made a bad slip. But it is probable that these thrombosis originate most commonly from infectious causes.

If their etiology is not well known, their pathology is, at least for those that affect the vessels of the extremities. Thrombosis being either incomplete or very slow in its development, the increased collateral circulation prevents all accident of gangrene. Besides this, the bloody supply is sufficient through the muscles when at rest; but if exercise is demanded of the animal, the quantity of blood that they receive is unable to insure thier normal functions and then occurs a true impotency of these ischemied muscles. At the time when the conditions of apparition of the lameness are realized, the region, poorly supplied, becomes the seat of an excessive pain; the aspect of the animal is anxious, the great functions are accelerated. If the artery can be explored beyond the obstruction, it is found that the pulsations have disappeared; palpation of the collateral of the canon give no longer the pulse. In the entire region where the diseased vessel is distributed, the skin is dry and cold, while it is hot and at times covered with perspiration in the other parts of the body, when the exercise has been too long. These symptoms, added to this peculiarity, that the lameness occurs after a certain amount of exercise and disappears after rest, are sufficient to establish the diagnosis of *arterial thrombosis*.

In the *thrombosis of the aorta and its division* the clot occupies variable positions: it is found in the lumbar portion of the vessel, at its bifurcation or in one of its terminal branches. The symptoms vary according to the location or the extent of the obliteration. When this is incomplete, either the gait is regular at the beginning of the exercise, or stiffness of the hind quarters, resembling that of sprains of the loins, is observed. More severe symptoms appear after a few minutes of trotting exercise: sometimes it is a more or less complete paraplegia, but as the lesions are always more marked on one side, it is more commonly a marked lameness of the corresponding member. It is easy to recognize the nature of these accidents and distinguish them from those due to sprains of the loins, to muscular lacerations or diseases of the spinal cord. The increased severity of the symptoms by exercise, the absence of arterial pulsation or the diminution of their force below the thrombosis and the lowering of the temperature of the extremity suffice to make the diagnosis.

Thrombosis of the brachial trunk is more rare than that of the aorta. Bouley, Schramb, George, Guntherberger, Weinberg, Möller, have recorded cases of it. The patient of Bouley had regular movements at the beginning of the exercise; after five minutes, he was lame on the left foreleg; after fifteen minutes, it was impossible for him to rest his foot on the ground; at the same time his respiration became accelerated and loud, the skin was covered with perspiration, except the lame leg. At post-mortem there was found an obliteration of the brachial trunk and its divisions (sus-scapular, great posterior muscular, epycondiloid, anterior

and posterior radial arteries). In the observation of George, after ten minutes of exercise the horse was lame on both forelegs; "they were semi-flexed, scraping the ground, and seemed dumb or paralyzed. At that time, the respiration was very labored, the beatings of the heart bouncing; the animal was anxious, the face contracted, the skin of the whole body covered with perspiration, except the two forelegs, whose hairs were dry and the skin cool." After fifteen minutes of rest these symptoms disappeared. At the post-mortem, one found a thrombosis of both brachial trunks; "the muscular structure was not discolored and presented nothing abnormal; it was the same with the nerves." In a seven year old mare, Möller has observed a similar case to that of George. Examination of the chest revealed hypertrophy of the heart; but at rest nothing abnormal could be detected in the forelegs. Trotting exercise, after ten minutes, brought out a general stiffness of the anterior quarters; the legs, the left especially, moved with difficulty, held in abduction, scraping the ground, the feet stumbling over the smallest obstacles in their way; the animal fell down repeatedly, and when up, would carry her shaking legs in abduction. The symptoms disappeared after five or ten minutes of rest, to return again after a short exercise.[1]

Therapeutics is powerless against arterial thrombosis. Alcalines are of no use. According to Goubaux, the daily administration of 20 grammes of iodide of potassium has given to Pilton two recoveries in cases of intermittent lameness due to obliteration of the crural artery. New facts are necessary to confirm the efficacy of this treatment. We have tried it on three occasions without results.

Massage of the aorta per rectum, recommended by Collin and Bayer, is useless and dangerous; useless, as the clot is not disturbed; dangerous, on account of the embolies its broken pieces might promote. Möller told us that he tried massage in a horse, and that death occurred in twenty-four hours. At post-mortem, with the old lesions a recent clot was found which obliterated the posterior aorta.

In rare cases, recovery has occurred under the influence of exercise.

[1] Numerous cases of thrombosis and obliterations of the terminal branches of the posterior aorta have been recorded in America by A. Liautard, Peabody, Ambler, Huelsen and others. The symptoms were those described by the author. The lesions varied. In one case of Liautard the obliteration involved the posterior aorta, circumflex iliac, external and internal iliac on both sides—on the left side the clot was traced in the tibial arteries to the hock. In another the internal iliac only with its ramification was involved. In Peabody's case both iliacs were blocked; on the external the clot extended to the femoral, popliteal and tibial arteries. In the case of Ambler it was found that the posterior aorta near its quadrification was partly closed by a large clot extending to the left iliac down to the femoro-popliteal. On the right side a clot existed also, but smaller.—American Vet. Review, vols. 4, 5 and 11.

To this effect it has been recommended to trot the patients until the appearance of the symptoms, to give them a certain rest, and another exercise and so on; by these repeated restings, when the current of the blood is stronger and more rapid, the clot would be gradually destroyed or removed in a collateral branch. But there is small hope of obtaining such result. Progressive increase of the affection is the general rule.

CHAPTER VIII.

VEINS.

I.

TRAUMATIC LESIONS.

Non-penetrating wounds of veins are, ordinarily, not serious. Punctures and cuts cicatrize almost always rapidly. Bruises and denudations are sometimes accompanied with thrombosis, phlebitis or escharrification of the venous walls and then secondary hemorrhages.

Penetrating wounds are made by puncturing, cutting or bruising objects. *Pricks* of veins, either by operations or accident, give rise to a more or less abundant flow of blood, varying with the size of the perforation. When the cutaneous opening is small, the blood becomes infiltrated in the perivenous connective tissue and in the cellular sheath of the vessel; an hemostatic thrombus is formed. *Wounds with sharp instruments* are complete or incomplete. Incomplete, they are longitudinal, oblique or transverse; it is with them that hemorrhage is persistent. Complete sections are immediately followed by a double longitudinal and circular retraction of the ends of the vessel, but nevertheless the hemorrhage is always abundant. In some cases, the central end bleeds little; in others the hemorrhage is great, as when a collateral branch opens between the wound and the first valve of the injured vessel. Transverse wounds of veins may rapidly prove fatal, specially when the circular retraction of the ends is prevented by adhesion of the vessels to the surrounding organs (aponeurosis, bones) or by diseases of their own structure. *Contused wounds* have their edges either clean or irregular and ragged. The hemorrhage is light and of short duration. Consecutive phenomena are the same as in the preceding wounds; however, they are followed more frequently with diffuse phlebitis, partial sloughing and secondary hemorrhage.

When there is *subcutaneous wounds*, the blood collects in the perivenous tissues, sometimes filtrates along the length of the vessel, in the musculo-aponeurotic spaces, where it coagulates.

Wounds of veins whose walls have undergone no pathological alteration have a tendency towards cicatrization. In incomplete solutions of continuity, temporary homostasis is made by a claviform clot which spreads

more or less in the perivenous cellular tissue, then obliterates the perforation of the vessels. If the trauma is protected from infection, circulation goes on; sometimes the cicatricial spot dilates and gives rise to the enlargement that is commonly observed on the jugular of horses. With complete sections, the mechanism of the temporary hemostasis is the same; effused blood coagulates outside the vessel, and then an intravenous clot of various length is formed.

The principal modes of treatment of venous wounds vary: *suture, pressure and plugging, cauterization and ligature of the vessel.*

Punctures of veins are treated by pressure or suture. When the cutaneous wound is small, simple compression is ordinarily sufficient; it stops the hemorrhage and prevents the entrance of air in the central end. Twisted or pinned suture of phlebotomy is an excellent means. The use of styptic substances and plugging have been recommended. Perchloride of iron, much used in old times, has the objection that it promotes the formation of extensive clots and sometimes a severe phlebitis. Larger wounds must be plugged with iodoformed gauze after careful disinfection. When pressure fails, forcipressure or ligating the vessel is indicated. If the wound is deep, to avoid much cutting, the vein can be closed with one or two hemostatic forceps, left in place for twenty-four to thirty-six hours. The best treatment for complete section of the vein, is ligature. Upon both ends, a silk or catgut thread is applied firmly, tied and stopped by a straight knot.

The *introduction of air in veins* is an accident that may occur when a vessel of some dimension, situated in the circle of the inspiration of the thorax and of the heart, is open during an operation.

A peculiar noise, a gurgling, sucking or whistling is suddenly heard, like that made by air entering by a small opening into the thorax of a living animal. Sometimes a severe dyspnea appears, the mucous membrane becomes pale, eyes are staring, pupils dilated, and death, generally preceded by convulsive movements, takes place after a time varying between a few minutes to several hours. Of the two cases recorded by Barthelemy, one died after seven, the other in eight hours. Some cases recover. Viardot had one case where lameness appeared suddenly after the introduction of air into the vessel.

Yet, the introduction of air is not always followed by noticeable disturbance, and already Dupuy, Liégeard, Rey, have insisted upon the great quantity of air that it is at times necessary to introduce into the veins to kill the horse.

The introduction of air into the veins should be avoided by applying pressure beyond the point where the operation is performed and relieving it only when the wound is closed or protected by the fingers. Frequently

this indication is neglected or imperfectly complied with, and yet no accident follows. In fact, it is very rare.

When it occurs, phlebotomy is advised, pressures on the thorax, artificial respiration. When it happens during bleeding at the jugular, it is recommended to apply immediate pressure in the jugular groove, continue to draw blood and even open another, so as to open a double way to escape with blood and the air it carries. (Bouley.)

In other cases, the vein is to be closed at once on the central end, with the finger or a forcipressure forceps, then have recourse to pressures on the chest and artificial respiration. When the severe symptoms have subsided, ligature is applied on the vessel.

II.

THROMBUS.

Thrombus is frequent in horses after bleeding. Often, even when the operation is well performed, a small tumor develops at the point where it has been open. The formation of an extra-venous clot is certain; it is the condition of the closing of the prick which has been made on the vessel; but when the bloody extravasation thus produced is small and infectious elements are not introduced in the wound, its resorption is rapid. The expression "thrombus" must mean bloody tumors of some size, developed after a venous puncture, whose resorption takes place only slowly or terminates by suppuration.

Rare in ruminants, it is common in horses. Bleeding on the veins of the leg, specially the axilla and the subcutaneous thoracic, are ordinarily accompanied with it.

The termination of thrombus depends on the presence or the absence of pathogenous micro-organisms in the clot. When no infectious element has been introduced in the wound by the flame, the resorption of the bloody tumor takes place by degrees and most ordinarily it is completed in a few days.

In contrary cases, it remains, inflames, becomes warm and painful; soon fluctuation is detected; the thrombus is purulent. It is possible that the infectious process reaches the vein, extends to the clot of the borders of the puncture and promotes phlebitis. The inflammation may spread more or less along the vein and give rise to a warm, painful swelling, simulating a phlebitis, and yet the circulation remains in the vessel.

When the ligature applied on the pin has been too tight, inflammation of the thrombus may end in the mortification of the cutaneous squeezed spot; this sloughed, the bloody tumor is widely exposed; it

suppurates and is at times complicated by inflammation of the venous walls.

Thrombus are avoided on some veins by methodical performance of the bleeding and taking all the necessary precaution it demands; such as an instrument whose length of blade is proportional to the caliber of the vessel, application of the pin and of the ligature without pulling of the skin, proper care after the operation.

Once the thrombus is formed, one must resort to antiphlogistics and astringents: cooling applications, alum water, white lotions, douches in spray. At the onset pressure and irritants are injurious. Their indication is limited to cases where the bloody tumor remains; then, the complications of suppuration and phlebitis are not to be feared.

If suppuration arises, the ligature must be removed, the wound enlarged to allow the escape of pus and repeated antiseptic washes made. Deep exploration of the suppurative center with the probe must be avoided, as it may give rise to phlebitis.

In bovines, thrombus is observed on the jugular, saphena and abdominal subcutaneous. On this last it is mostly found; it is ordinarily enormous and disappears more slowly than at the jugular. The treatment is the same as that of solipeds.

III.

PHLEBITIS AND THROMBOSIS.

The relations which exist between phlebitis and thrombosis, between inflammation of the veins and the coagulation of the blood, have given rise to different opinions, and promoted numerous experimental researches. The question as to which of these two processes was essential and primitive has been the subject of many discussions.

During the first half of this century, the theory of primitive phlebitis, as expressed by Hunter, was universally accepted. It was in 1856, that Virchow advanced that of the primitive venous thrombosis. For him, the coagulation of the blood in the vein is not a secondary alteration, consecutive to the inflammation of the walls of the vessel; this thrombosis is the essential and primitive phenomena of a process which ends in phlebitis. Thrombosis is the starting point of adhesive phlebitis; it is also the first act of suppuration; which "is a pathologic phenomena commencing by a coagulation and ending in softening of the thrombus; the alterations of the venous coats are secondary." Some anatomo-pathologists, Cornil and Ranvier among them, have continued to teach the existence of the primitive endophlebitis, but it must be said that the German opinion as that which prevails to-day.

It has been tried to explain thrombosis in the various circumstances where they take place, either by an alteration of the blood or a change in the structure of the venous wall. And again, successively were suspected the excess of fibrin in the blood (hyperinosis), the exaggeration of its coagulability (inopexia), the qualities of the serum, the excess of white globules, the abundance and abnormal viscosity of the hematoblasts,—and at last the simultaneous interference of several factors: such as a mechanical disturbance in the venous circulation, in the diminution in the bloody current, or in an alteration of this fluid. But none of these influences has, from the point of view of the production of thrombosis, the importance that is offered by the condition of the venous endothelium. The diminution or even the arrest of the circulation through a vein do not give rise to thrombosis, if the endothelium is perfect in its integrity. "Blood has been kept in a venous segment, between two ligatures, during several hours, even several days. On the contrary, as soon as the slightest alteration occurs on the endothelial surface (for instance, in striking the external face of the vein with a forceps), immediately clots are formed on the diseased spot, as it takes place round a foreign body introduced in the vessel" (Quénu). That which dominates in the formation of thrombosis, is the alteration of the venous endothelium.

Bacteriological researches have shown this alteration in cases where the naked eye examination would not permit it. Some thrombosis reputed primitive have at last been recognized as secondary, of infectious nature, promoted by micro-organisms. Spontaneous thrombosis, so called, is most often but an attenuated form of phlebitis. "Between thrombosis called spontaneous and suppurative phlebitis, there is only a difference of degree; the lesion is the same, the cause is identical."

In its turn, the theory of Virchow had to give its place to the microbian. "This new doctrine considers some thrombosis (if not all) as of infectious nature; it rests on severe observations and the presence, on the inside of thrombosed veins, of pathogenous micro-organisms; it brings us back to the conception of primitive phlebitis, anterior to the clot; it adds a pathogenous notion of great value, viz: that this phlebitis recognizes for cause the action, upon the living endothelium, of a microbian agent" (Quénu).

Phlebitis is specially common on veins where bleeding is performed, in particular, in the jugular of horses, and the subcutaneous abdominal in bovines. *Umbilical phlebitis*, frequent and dangerous in young subjects of all classes, shall be studied later on, in the chapter on *Arthritis of Young Animals*.

There are several varieties of phlebitis. They are divided into *superficial* and *deep*, *internal* and *external*, *traumatic* and *spontaneous*, *infec-*

tious, constitutional and *toxic*. We will only consider them, as in Hunter's old division, as *adhesive, suppurative* and *hemorrhagic*. It is these which apply best to veterinary practice.

Phlebitis and thrombosis being, in the very great majority of cases at least, the result of a microbian pullulation, of an infection whose ordinary agents are the staphylococci; and again, adhesive, suppurative and hemorrhagic forms of phlebitis being related to various degrees of virulence of the causal condition, the treatment of the inflammation of veins must specially consist in the use of antiseptics.

Phlebitis following operations performed upon veins shall be avoided by the observation of the rules of asepsy. One will not neglect that all venesection, to be harmless, involves the disinfection of the region and of the instrument that opens the vessel. By the antisepsy of wounds containing exposed veins, situated or involved in the traumatic center, the infectious inflammation must be guarded against.

As soon as the diagnosis of *adhesive phlebitis* is justified, by the appearance of an indurated cord, surrounded by an œdematous swelling, the region must be immobilized and protected against all causes of irritation; not only thus limiting the venous phlegmasy but also guarding against the breaking up of the clot and against embolies. (See *Traumatic Thrombus* and *Embolies*). In most of traumatic phlebitis, there is, at the wounded spot, a fistula which demands special care. The region will be clipped, and disinfected, the escape of the pus will be facilitated by enlarging the fistulous tract; and this will be irrigated several times a day with an antiseptic solution (sublimate 1 p. 100, phenic or cresyled water 3 p. 100); and the wound will be covered with powder of iodoform or tannin, phenicated or iodoformed vaseline. Preparations of vaseline are preferable to lard ointment, which becomes rancid, irritates and makes the skin itchy. In phlebitis of the extremities, douches in spray, given several times a day, are advantageous. Later, when the acute phenomena have disappeared, blisters are useful as resolutives, as recommended by Renault, Bouley, Rey.

When phlebitis is *suppurative*, so that the clot is infiltrated with pus, the inflamed vein is becoming fistulous, the swelling increases, abscesses are formed in various parts of its extent; more than in adhesive phlebitis, the danger of portions of the clot becoming loose and purulent infection must be feared. There is escape of abundant pus, thin, of bad aspect, grayish or reddish and at times having a fetid odor. A probe introduced into the wound may penetrate far into the vein. It is proper to enlarge the fistula and make in the vein antiseptic injections (tincture of iodine, solution of sublimate, of phenic acid) with an india rubber tube adapted to the end of the syringe or with the bent canula (Nocard). This treatment, simple of execution, is recommended at the beginning, when sup-

puration is limited to a small distance in the vein; it is insufficient when the phlebitis is old, when the vascular walls are infiltrated with pus, and the abscesses are developed in the perivenous structures. The vein must be drained in its suppurating portion. After making a counter opening on a level with the intravenous fistula, a fenestrated rubber tube is introduced in the tract to insure the escape of pus and allow the cleaning of the vein. We will return to this, in the article on suppurative phlebitis of the jugular.

Another treatment consists in cutting down in its whole length the portion of the fistulous vein and treating the part exposed. Like Hoffman, it is better, after exposing the vein in all its suppurating portions, to clean it by curetting; to leave no diseased point in the neighborhood of the clot, clean the operated surface with a strong antiseptic solution and dress with iodoform. In the legs the curetting can be completed with antiseptic baths; for the other regions, sprays are indicated. Between these the wound will be protected with compresses dipped in microbicide solution, or with antiseptic vaseline.

Ligature and extirpation are means which to-day are little used. In some serious cases where free incision is dangerous, cauterizations with fine points or with needles, of the suppurating venous portion, has brought on recovery.

Hemorrhagic phlebitis, complication of the adhesive and suppurative forms, due to the loosening, crushing, purulent destruction of the obliterating clot, is treated by plugging of the wound, suture of its borders or ligature of the vein. This last operation must be done antiseptically on a sound part of the vessel and beyond the induration. Layer by layer the tissues covering the vein are excised, the vessel is isolated and surrounded with an aseptic silk thread tied with a straight knot. The wound is irrigated with boiled water, is dried, dusted with iodoform, the edges brought together by two or three stitches, the whole covered with a collodion dressing. As for the fistula and the suppurating portion of the vessel, they demand the same care as indicated for adhesive phlebitis.

IV.

VARICES.

Generally speaking, permanent dilatations of veins, *varices* or *phlebectasis*, are rare in all animal species.

They occur most commonly on the veins of extremities, or those of the organs where the venous current has an ascending direction. In horses, they have been observed on the radial, saphena, axillary and testicular;

in cattle, on the testicular; in cows, on the mammary; in pigs and dogs, on the scrotal veins. In a two-year-old filly, Debloc has observed a varice of the mammary vein as big as the head of a child. The extreme rarity of hemorrhoids in all animal species is explained by the direction of the pudic veins, and by the less pressure of the current of the blood, in these vessels, in animals than in man.

The varicous dilatation of the saphena at the fold of the hock must not be mistaken for the synovial dropsies found in that region. Varices of the mammary veins, in bovines, may become voluminous, but do not give rise to serious complications. Deep venous ectasis are accompanied with dumbness, stiffness of the extremities and more or less pain.

Varices are lesions of a slow, chronic development. In general they remain permanently, stationary or increasing little by little. Spontaneous recovery is possible by the formation of adhesive phlebitis, which obliterates the vessel. Left to themselves, they may become complicated with phlegmonous inflammation, ulceration and hemorrhage. In the case of Gillibert, the rupture of a varice of the axilliary vein was followed by death.

The principal means of treatment of superficial varices are: *pressure, cauterization, ligature, extirpation* and *coagulating injections.*

Radical cure of veins is seldom undertaken in horses. If it is to be attempted, a simple or double ligature should be applied above and below the dilatation, with all required antiseptic precautions. In the case related by Debloc, he made on the tumor two punctures with the fleam, closed with pin suture and applied blisters. Notwithstanding the result, in this case, ligature is better.

If surgical interference is not resorted to, douches, cold baths or pressure with bandages are indicated.

CHAPTER IX.

LYMPHATICS.

I.

CONTUSIONS—WOUNDS—FISTULAS.

The slightest cutaneous or mucous wounds involve the lymphatic network, whose numerous canals drain the superficial layers of the dermis. Limited to the capillaries, these lesions are without importance: a small quantity of lymph mixes up with the blood, then the divided vessels cicatrize. They offer a certain gravity when large vessels are open. In animals, the superior face of the internal face of the legs and round the articulations are places where these wounds are most met. They give flow to a serous liquid, which might be mistaken for synovia, when the traumatism is near an articulation. The weak viscosity of the lymph, its whitish color, its coagulability, abundance of its white globules, the cessation or increase in the flow whether pressure is applied in the direction of or against the current, all those establish the diagnosis. Often at the moment the wound is made, there may be seen a true jerk of fluid, which afterwards escapes in sheath, more or less abundant, increasing by exercise, which may make the flow return by jerks.

A pinned suture is generally sufficient to arrest the hemorrhage. The compression of the leg, from its extremity to above the lesion, made with a flannel or a rubber roller, completed with an antiseptic dressing, slightly compressive, also gives good results; by this way, the exit of the lymph contained in the open vessel is stimulated and the fluid mass carried during the following days is reduced, thus facilitating cicatrization. Spontaneous recovery is possible even in large lymphatic canals. Monro has seen, in a pig, the thoracic duct, artificially wounded, cicatrize rapidly.

Having become fistulous, lymphatic wounds are tenacious. They are treated by cauterization with nitrate of silver or sublimate or with the red iron. Some practitioners prefer the injection of tincture of iodine. Ligature applied on the peripheric end will be used if other means have failed. It is sometimes difficult to apply it, and the operation is frequently followed by an infiltration of some size of the extremity. Absolute rest is indispensable, if quick recovery is expected. Infectious inflam-

mation is possible. If it occurs, the treatment of suppurative lymphangitis must be carried out.

Subcutaneous ruptures of lymphatics give rise to the affection described under the name of *traumatic effusion of serosity.*

Bruises of *lymphatic glands* are not generally followed with special complications. Their treatment is that of bruises in general.

Wounds of glands are rare. They may, however, be accidentally injured by wounding bodies and instruments of surgeons. The lymphorragia, concealed by the hemorrhage, stops with it. In the majority of cases, these wounds demand only an antiseptic dressing and immobility. When the flow of lymph continues, canalicular tract is established which must be treated as the fistulas of lymphatic vessels. Extirpation of the glands is sometimes necessary.

II.

LYMPHANGITIS.

Always secondary and produced by the entrance in the lymphatic vessels of phlogogenous infectious elements, *lymphangitis* or *angioleucitis* present numerous clinical varieties in all animal species. Generally those that are observed are of traumatic nature and have for starting point a tegumentary solution of continuity,—wound, prick, ulcer, abrasion. In cases where no apparent solution of continuity exists in the region, whose lymph is collected by the inflamed lymphatics, angioleucitis is the consequence of either an interstitial auto-inoculation (glanders, distemper, tuberculosis) or of a micro-trauma, rapidly wiped out, which still has lasted sufficiently to permit the passage of infectious elements. Numerous facts have shown that lymphangitis may appear after bruises without noticeable wound, repeated frictions, or cutaneous impregnation by septic or putrid fluids. There are slow lymphangitis, "with incubation," which are manifested only a long time after cicatrization of the wound through which the agents of infection have entered; often then a shock or repeated frictions are the cause of this "inflammatory return."

Acute or chronic, superficial or deep, lymphangitis are *truncular*, *reticular* or *radicular*, as they affect the lymphatic trunks, the cutaneous network or the roots of the white vessels in the various tissues. Favored by some constitutional or diathetic conditions, they are produced by very various pathogenous agents: there are as many kinds of lymphangitis as there are micro-organisms susceptible to irritate the white vessels.

In inflamed canals, one often finds the staphylococcus albus or aureus, sometimes the streptococcus pyogenes, the bacillus coli or some leptotrix. Histology and bacteriolgy have permitted the distinction

of other forms of lymphangitis which we will study further on. Glanders, distemper, tuberculosis, carcinosis produce specific angioleucitis.

The prognosis of those affections depends specially on their nature and the activity of the microbe that has caused it. When pathogeneous agents have but little virulence, the process has a tendency to subside, the morbid contents of the lymphatics is easily resorbed. Very active microgerms may, on the contrary, bring on suppuration or gangrene. The close relations between lymphatics and the serous system explain the complications of hygroma, synovitis, arthritis, peritonitis, which are sometimes observed.

Traumatic lymphangitis, the most interesting to the practitioner, is common in horses. We will give to it our special attention.

I.—Traumatic Lymphangitis.

This form may succeed all solutions of continuity of the skin. It is often seen in the withers, the shoulder, the neck, which are so commonly the seat of traumas. A simple abrasion, the prick of a dirty lancet, are sufficient for its development. It ordinarily begins by a reticular angioleucitis, accompanied with great sensibility, bristling of the hair, œdematous swelling of the skin; and soon the trunks and the collecting glands are affected.

There is a form of lymphangitis, specially frequent in the hind extremities of horses, characterized principally by the suddenness of the invasion and the intensity of the first symptoms. A horse in perfect health in the evening is found the next morning dull, feverish, hanging his head, with a more or less marked and very painful swelling of a hind leg. The lameness is intense, the animal moves with difficulty and carries its leg in abduction. By examination, an œdematous swelling, painful in proportion to the severity of the attack, is detected on the internal face of the extremity. Appetite is partly or entirely gone. The following days, the swelling keeps on increasing until it assumes the form of a shapeless post. This sudden appearance of the affection and the great sensibility of the internal face of the hind leg are characteristic of the infectious inflammation of the lymphatics; most ordinarily, they justify the diagnosis of this so frequent variety of angioleucitis. Old writers, among them Solleysel and Garsault, attributed it to the bite of the "shrew mouse." Lafosse refuted this error; he thought it to be a variety of anthrax, against which he recommended scarification and repeated emollient lotions. In a paper addressed to the *Société Centrale* (1862), Mottet described the disease under the name of "*Tarsopathy* and *Metatarsopathy*, or the diffused inflammation of the tarsus and metatarsus." The discussion which followed

the reading of the paper by Leblanc was most interesting and proved that the nature of the affection was yet a matter of much controversy. However, the theory of Mottet, who saw in it a tarsal inflammation, was not accepted. Several advanced the idea that those symptoms, so rapid and so accused, might be due to phlebitis of the saphena. Bouley claimed that the cord of the inner face of the thigh was due to lymphatics and not to venous blood vessels, that it was a lymphangitis and not a phlebitis. To-day, the fact is no longer discussed. Everyone recognizes in it an inflammation of the white blood-vessels. This lymphangitis, so frequent on the hind legs of heavy draught horses, sometimes recurs at more or less remote periods. Some subjects seem to be predisposed to it. On examination of the leg, one finds a cutaneous solution of continuity, at times cracks, pricks, but quite frequently no door of entrance to the pathogenous agents can be found. The conclusion is that it is a lymphangitis without previous inoculation. If there is no visible solution of continuity, it is cicatrized or is so small that it escapes attention. Auto-inoculation (endogenous infection, latent microbism) is extremely rare.

When lymphangitis follows an operation—nevrotomy for instance—the process is about the same. A few days after the operation, often after twenty-four or forty-eight hours, the swelling of the leg is well marked, the pain great, the resting of the foot on the ground suppressed, the appetite diminished or gone. The wound contains little or no pus, its edges, tumefied, are covered with a yellowish coating, diphteroid in appearance, somewhat adherent. After several serious affections of the leg, synovial inflammation principally, *deep lymphangitis* may occur, whose symptoms and prognosis are often most severe.

Bacteriological researches made by us several years ago on suppurations of horses and dogs, allow us to affirm that, in these species, traumatic lymphangitis are almost always the work of staphylococci and more particularly the *staphylococcus pyogenes albus*.

The treatment must be specially preventive. Asepsy and antisepsy of the operation guard against this complication. Accidental traumatisms, specially wounds of the lower parts of the legs, should be carefully washed and protected by a dressing. By a correct antisepsy, the retention of the pus on suppurating surfaces and the infections of lymphatics will be prevented.

As soon as lymphangitis exists, an active therapeutic must be started. Up to later days, bleeding was recommended; many practitioners performed it on the jugular. Mottet preferred scarifications (eight or ten to the hock, fifteen or twenty to the cannon) two or three centimeters long, one or two deep; he then soaked the leg in tepid water and thus obtained a bleeding of two or three liters. According to Serres, three or four fric-

tions of ammoniacal liniments were sufficient to obtain a rapid resolution. The same author had also obtained good results with embrocations of mercurial ointment, repeated eight or ten times. D'Arboval and Rey advocated the use of blisters; this, says Rey, "succeeds very well on the internal face of the cannon; one application is generally enough." Several veterinarians resort to the charge of Lebas over the whole of the inflamed region; others use populeum ointment, or again others prefer poultices.

All these means have only a mediocre efficacy. Lymphangitis being the esultr of microbian injection, antisepsy must be the base of the treatment. One must act at the same time on the inoculated lesion, and the lymphatic inflammation, wounds, cracks, pricks, should be minutely disinfected with a sublimate solution (1 p. 1000), cresyl or phenic aid (3 p. 100), and covered with a wadding dressing. Slight angioleucitis should be treated often by cold baths or douches, massage and exercise when the pain has subsided. General symptoms pass off first, but often the swelling remains for two or three weeks.

When lymphangitis is severe, when it is a complication of a wound of operation or of one accidental on the extremities, warm antiseptic baths are indicated. They will be administered two or three times a day and last half an hour each. It is advantageous to cover the inflamed surface with tepid phenic or sublimated compresses. The absorbed fluid progresses in lymphatics, where they bring their direct disinfecting action. Damp moisture favors the resorption of exudates; perhaps in some cases they act in reducing the virulence of infectious elements. In other regions, one may advantageously use antiseptic washing or spraying and protect the wound with a dressing. To reach with more certainty the pathogenous elements, some authors have advised injection of phenic water at 2 p. 100, here and there along the course of the inflamed lymphatics. Repeated coatings of the leg with a solution of perchloride of iron at 3 p. 100, or diluted tincture of iodine, are worth trying with antiseptic baths. With deep lymphangitis, antiseptic balneation is also a good mode of treatment. By it, the inflammation and the pain rapidly disappear, and complications are avoided.

Instead of ending by resolution, lymphangitis may pass to suppuration: pus forms in the lymphatic vessels, in the perilymphatic cellular tissue and sometimes in the thickness of the dermis. In some parts of the lymphatic cord, rounded fluctuating tumors are formed. And from them, either after ulceration or if open by puncture, escapes a thick, whitish pus.[1]

[1] In the case related by W. C. Siegmund, the original cause of the lymphangitis remained unknown. Several superficial abscesses had formed on the coronet, inside of the hock, alongside the thigh, some 40 in number. Tested with mallein, negative

Antiseptic cleanings insure the cicatrization: it is rare for lymphorrhagy to last; when it occurs on the extremities, it is always the most dependent abscess which becomes fistulous. Diffuse suppuration and undermining demand counter-openings and drains. It is specially with deep lymphangitis that sub-aponeurotic purulent collections and extensive gatherings are to be looked for. Puncture of the fluctuating points is not always sufficient; the swelling must be carefully watched; if the presence of a purulent infiltration is suspected, explorating punctures must be made.

Septic or gangrenous forms of lymphangitis are rare. However, they have been observed for many years (Vatel and Crepin). A first important indication consists in making, in the swelling, punctures with the red iron. Frequently repeated antiseptic baths or sprays are to follow. In serious cases (diffused suppuration, septic complications, gangrene) tonics, alcohol, and antiseptics should be given internally.

Chronic lymphangitis develops in two ways: at times it appears at the onset and by degrees reaches its definite characters; or again, it follows the acute form. In this last case, the swelling of the upper part of the leg subsides, it remains more or less marked at the coronet, fetlock or cannon, and there the induration gradually organizes itself. The œdema spreads in the cellular tissue, irritates it, and also the deep surface of the skin, the exuded fluid becomes fribrinous, the subcutaneous tissues become indurated, the skin is thickened and sclerotic.

Against these cold swellings of the lower regions of the extremities, therapeutics is rather poor. Blistering has given some success to Leblanc and Mottet, but fails in most cases. The same can be said of the various liniments and tonics recommended. According to Siegmund and Zundel, laurel and camphorated ointments, mixed with extract of belladonna, constitute a true specific to remove the œdematous swelling—an opinion which has not been approved by experimentation. Cauterization has been frequently used; if it has seemed successful with Lardit, Leblanc and many others have seen it fail in their hands. Many cases might be mentioned where firing and blistering have aggravated the swelling. Seton at the thigh, on the gluteal region, and scarifications have had and have yet many advocates.

Is it proper to follow an internal treatment? Jacob, already in 1855, advised iodine or iodide of potassium, after having obtained some results from them. Here, as in numerous affections with sclerotic tendency, iodide may be useful, specially in recent cases. Yet its action must not be too much depended upon.

Sometimes chronic lymphangitis resists all treatments; the coronet, fet-

results were obtained. At the post-mortem a large abscess was found in the thickness of the ischio tibial muscles.—*American Veterinary Review*, vol. 18, page 290.

lock and cannon swell more and more, and whether or not acute attacks reappear, arrives the process comes to the elephantiasic fibroma. Moderate exercise, thorough cleanliness of the extremity, hot water, massage, moderate and intermittent compression with flannel or rubber bandages; such are the best indications to follow. Elastic pressure, as we have said, demands some attention. A pad of oakum or wadding should always be laid against the skin before the not too tight roller is applied and not allowed to remain more than ten or twelve hours. Excessive or continued pressure promotes sloughing of the skin and of the tissues underneath. If abscesses form, they should be opened at once. Chaps and cracks of the skin should be treated by antiseptics and rest. By moderate pressure also the œdemas occurring under the influence of standing in the stable or during rest at night will be prevented.

II.—Specific Lymphangitis.

Epizootic lymphangitis, also called *farcy of Africa, farcy of Naples, farcinosus lymphangitis*, is a specific, contagious affection, produced by the *cryptococcus farcinosus* of Rivolta. It is proper to solipeds. Very common in Africa and at the Guadaloupe, it is rare in France.

In the infected localities, wounds of all kinds may be followed by it. It is observed principally on the legs, the withers and the lateral parts of the trunk. Its incubation varies from a few days to several months. The borders of the wound become indurated and very painful; in its surroundings appear pimples (buttons) and then cords progressing along in the direction of the lymphatic current; the collecting ganglion later on forms a mamillated hard tumor. After a certain time, cords, buttons and glandular tumors become soft, ulcerate and allow the escape of a laudable, creamy pus. These wounds, "cul de poule like," cicatrize very slowly; many become fistulous. The invaded region is always much engorged; the legs assume shapeless sizes. The observations of Blaise, Couzin, Nocard, have shown that this affection, localized to the pituitary membrane, may give rise to ulcerations resembling those of glanders.

At times difficult, the diagnosis can be established by microscopic examination, the specific microbes being in abundance in the pus and in the superficial layer of the wounds. Mallein gives also good indications.

The disease existing almost always upon a more or less large number of animals, the most elementary prudence imposes the sequestration of the patients. *A ministerial order* (February 11, 1887) prescribes the measures to take with horses and mules of the army. In civil practice, besides isolation, disinfection is recommended. During rainy weather, wounds of all kinds should be treated antiseptically and protected with a dres-

sing. These measures are generally sufficient to arrest the progress of the disease.

The curative treatment is composed principally of external applications. After Tixer and Delamotte, several veterinarians have tried without success internal treatment with arsenious acid, kermes, iodide of potassium, mercurial compounds, nux vomica, tincture of iodine, hyposulphite of soda. To this day, however, we do not know of therapeutic agents, which, given internally, arrest the pullulation of the pathogenous element. To give the patient a nourishing food is the important indication; and tonics and stimulants are useful.

Every author recommends to open the buttons with the red iron; to render the cauterization deeper, some dust the tract made by the iron with sulphur powder and burn it over. Decroix added to these points one line of deep cauterization applied transversely in front of the lymphatic swelling, which never went beyond this barrier. Nocard has advised a free incision in the whole length of the cord and the destruction of its internal wall by curetting or actual cauterization. Others have recommended the extirpation of the cord with the thermo-cautery, taking with it some of the healthy tissues. Peuch has seen this done with complete success. Jacoulet has warmly recommended the free extirpation of the cord and of its glands. The operation is simple when the cord is small and well defined; it becomes very difficult when the swelling is large, extending from one end of the leg to the other, specially when the cord, the vessels and nerves are involved in the same fibrous thickening. On this account, extirpation remains limited to few special cases. Points firing with free incision of the cord and curetting are specially applicable to extensive lesions. To stimulate the cicatrization of wounds thus made, several topics have been recommended; blisters, tents soaked in camphorated and phenicated alcohol (Wiart), burnt alum, sulphate of copper, Rabel solution, nitrate of silver, tincture of iodine, diluted nitric acid. Antiseptic liquids (injections, baths, repeated sprays, with solution of cresyl or phenic acid 3-4 p. 100, sublimate 1. p. 1000) and dressing with iodoform, deserve preference over the others.

Actively treated, the affection ends ordinarily by recovery after a lapse of time varying between several weeks and two months. In some cases, cicatrization of the wounds has required five, six and seven months.

Besides the traumatic lymphangitis and the pseudo farcinous form, other lymphatic inflammations are met with in animals which are due to special parasites or to specific processes.

The *farcy of oxen*, very rare in France, common at the Guadaloupe, has for principal manifestation a suppurative inflammation of the lymphatic vessels and glands. The disease may invade the visceras (spleen, liver,

lungs), bring on excessive emaciation and end in death. It is not glanders, nor tuberculosis, but a special microbian affection. In the post-mortem pieces sent to Nocard by Couzin, he found a "fine and long bacillus, assuming the form of little snakes entangled together; the central part resembling an opaque nucleus, from which radiated towards the periphery delicate ramified threads; it gives the idea of the head of a cauliflower, a bundle of thorns, or, better, a seed of burdock." It is inoculable to the guinea-pig, cow and sheep. Horse, donkey, dog, rabbit, are refractory. On these animals it only gives rise to a small abscess at the point of inoculation.

Puncture of the abscess, made at an early date, free incision of the cord, cauterization, curetting of their internal surface, constitute the local treatment. Good food, tonics, stimulants, are also indicated. Recovery occurs generally; but one must count with the inflammation of the surrounding lymphatic vessels and glands, and many subjects die in marasm.

Tuberculous lymphangitis have been studied but little in animals. Godbille records an interesting observation of it. A steer in good condition had on "the external face of the right anterior leg, a linear series of bosselated, irregular tumors, of the size of the fist and moving under the skin." The lower one was ulcerated, others showed fluctuation. On post-mortem, all the internal organs were healthy, except some mesenteric glands, infiltrated with granulations. Recognized early in some species, tubercular lymphangitis may be treated either by incision and curetting, or by excision; in some cases, the extirpation of the collecting ganglion completes the interference. (See *Tuberculosis.*) *Cancerous* lymphangitis, common in dogs, are most always present in cases of serious epithelial tumors. Very frequent in the mammæ of sluts, they constitute thick subcutaneous cords, nodular, and extending to the glands. Their total extirpation, when the disease is comparatively recent and the patient strong, is the only proper treatment. Old age, anemia, generalization of the neoplasms, counter-indicate interference. (See *Tumors.*)

Lymphangitis of *distemper* are ordinarily not serious. In general, abscesses punctured and freely opened recover by the simplest antiseptic cares and the lymphatic induration diminishes little by little.

III.

ADENITIS.

True filters placed on the course of lymphatics, the glands arrest infectious germs carried by the lymph. Their pullulation, the increasing irritation that they produce on the glandular stricture, promote *adenitis.*

For a long time, it was believed that *adenitis* were *primitive*, but it is admitted to-day that the glandular inflammation results, in all cases, from an inoculation produced either directly through a wound of the gland, or indirectly by a lesion some distance from it, existing on the course of the afferent blood-vessels. Glands seem even more *sensitive* than the vessels; in clinics, lymphangitis without adenitis are exceptional; adenitis without lymphangitis are not.

If the most varied micro-organisms circulating in lymph may irritate the glandular sifter, acute adenitis, like lymphangitis, are ordinarily produced in animals by staphylococci and sometimes by streptococcus. The researches of Schwarznecker and ours show that ordinary adenitis of horses are generally due to the staphylococcus albus. The clinical varieties of adenitis (tumefaction, induration, suppuration) are related to the varying virulence of this staphylococcus. It is the streptococcus of Schütz which causes the suppurating adenitis of distemper. In bovines and other animals, acute adenitis of various nature have also been observed, most of them due to ordinary pyogenous microbes.

Ordinarily produced by inoculation from a wound at some distance from it, adenitis demands first the use of antiseptics on the wound and the afferent lymphatic blood-vessels, completed by a wadded dressing. The primitive lesion, cutaneous or mucous, should be treated by antiseptic irrigations, pulverizations or baths frequently repeated. Hot balneation is to be preferred. Upon the inflamed gland, tincture of iodine may be applied, a blister, or better, when possible, tepid antiseptic compresses. Intra-glandular injections of phenicated water 3 p. 100 (Hueter) have not been tried in animals. General and local bleeding are abandoned.

The march of the inflammation depends on the degree of virulence of the germs. A well made antisepsy will get the best of a microbe with weak virulence; little by little, the swelling diminishes, the pain subsides, resolution takes place. Other germs, more active, produce pus. As soon as it is formed, it must be allowed to escape and then antiseptic washes used. The opening of some glandular centers—subparotid or retro-pharyngeal abscesses, those of the axilla or of the groin—demands some attention; in these regions, the bistouri must be handled with prudence, if large vessels and nerves are to be avoided. The free incision of the maxillary glands is without danger, and the puncture occupying dependent location, pus always runs freely. At times, specially under the parotid, the pus has reached the periadenic cellular tissue, there are great underminings and the glandular origin of the abscess is difficult to locate. In such cases the incision must be made large or a counter opening established; drainage is also obligatory. Ordinarily the wound closes rapidly. If healing goes on

too slow, the wall may be curetted, dressed with iodoform or injected with tincture of iodine or iodoform ether.

Sometimes *chronic adenitis* follows the acute form; at times it occurs at once, either under the influence of specific diseases (glanders, tuberculosis, carcinosis), or as consequence of a sub-acute or chronic inflammation. The glands of a same group become hypertrophied and remain independent (simple adenitis), or they gather and unite into a single mass (adenitis and periadenitis).

In general, chronic adenitis are little painful. They have a great tendency to last, and when the affection which has promoted them has disappeared, it takes a long time for them to disappear. Slow resolution is not their only termination; sclerosis is frequent; an acute return may bring suppuration.

The treatment must, first of all, look after the causal lesion. In proportion as the wounds of the legs cicatrize, the glands of the axilla or of the groin resolve. Similarly, the maxillary gland diminishes in size when the purulent collection of the sinuses goes toward recovery. Local treatment has little efficacy. Blisters have been recommended, napolitan ointment, tincture of iodine, iodurated pomatum. If these are not successful, superficial or deep cauterization deserves trial. Extirpation of the indurated glands has been little performed in animals. We only use it to establish the diagnosis in specific adenitis. In all cases, iodine of potassium internally will help.

Suppuration of chronic adenitis is treated like that of acute: incision and antisepsy.[1]

IV.

TUMORS.

Primitive tumors of glands are extremely rare. Almost always secondary, they generally accompany epithelioma and carcinoma, sometimes sarcoma or enchondroma. In cancer, the glands, run through by the lymph of the affected ground, are always suspicious. Generalization begins at the nearest gland, that which collects the lymphatics of the primitive focus; hence it spreads little by little; and frequently true neoplastic

[1] Dr. F. S. Allen has recorded two cases of chronic adenitis successfully cured by the removal of the enlarged gland. In one instance, microscopic examination proved it to be a small spindle celled sarcoma. The whole tumor weighed eight ounces. In the other, the growth weighed only four ounces. Microscopic examination showed it to have been originally lobulated, with hollows at intervals and at points containing small abscesses. It proved to be a lymphatic gland in a hypertrophical condition undergoing an irregular process of regeneration.—*American Vet. Review*, vol. 8, pages 183 and 185.

chains are observed. Staphylococci with attenuated virulence may promote glandular indurations resembling tumors; but the fact is rare; it is observed, however, with the submaxillary glands of horses; fistulous indurations can also be met in them, which suggests the presence of ulcerated tumors.

Entire ablation is the only proper treatment. Easy for primitive tumor and superficial glands, it may be impracticable for deep ones. The condition of success is to operate early and stop only when healthy tissues are reached. All surgical interference is contra-indicated when the disease has gone beyond the glands that may be reached by the bistoury, specially when there are evidences of generalization.

V.

LYMPHANGIECTASIS.

Those are glandular, truncular, or reticular. In man, *spontaneous lymphangiectasis* have been described, whose cause remains to be determined, and *symptomatic lymphangiectasis*, related to the inflammation or compression of the white vessels. In diseases of the heart or of its envelopes, there exists sometimes a general dilatation of the whole lymphatic system. At the autopsy of a horse suffering with valvular endocarditis of both left openings, with extensive hypertrophy of the right heart, Nocard found "such dilatation of the lymphatics that the thoracic duct had reached the size of the arm, and that upon the colic mesentery, the chilliferous vessels, filled with transparent lymph, measured one and one-half to two centimeters in diameter." Such lesions are of no interest in a surgical point of view, and lymphatic varices are extremely rare in animals. Nocard has related two cases of them. In one, it was a soft tumor, "puffy and fluctuating, of the sheath; repeated capillary punctures gave at each time a small quantity of limpid transparent fluid; a serous, multilocular cyst was suspected. Post-mortem revealed that it was a gathering of large lymphatic vessels rolled upon themselves, entangled intimately, whose walls, thick and very adherent at their points of contact, had preserved in any other part of their length their characteristic thin aspect and their transparency; numerous valvular contractions could leave no doubt as to the nature of the tumor.

"In the other case, the varices were on the lymphatics, satellites of the saphena vein, not far from the groin, where they formed little soft tumors, fluctuating, extremely irregular, enveloping the vein all round, upon a length of about twelve centimeters, to such an extent that it was impossible to bleed at that vein; and that it could not be opened except at the lower part of the shank, below the inferior border of the short adductor.

"In both cases, the dilatations were surrounded with a thick layer of connective tissue, gorged with serosity and on the road to induration."

For man, elastic stockings, knee caps or cuffs form the whole treatment. Analogous means might be tried in animals. Extirpation gives no good results; all surgical interference must be avoided. Sometimes superficial dilatations ulcerate; in these cases the therapeutics is the same as that of lymphatic fistulas.

CHAPTER X.

NERVES.

I.

TRAUMATIC LESIONS.

Traumatic lesions of nerves are accompanied with complex troubles, divided into *immediate* and *consecutive*. The former are known for many years; the others have brought about numerous discussions, and, actually, the pathogeny of those is not yet entirely elucidated.

Whatever may be the nature of the wounding body, the phenomena that take place in the ends of the bruised or divided nerves, are about the same in all cases. For centuries, the Galenic assertion, "any nerve cut cannot grow nor unite," has been admitted. But facts are related, showing that the sensibility and mobility sometimes reappear in regions where they were temporarily abolished by division, with or without loss of substance, of the trunk which innerve them. It appeared, then, that divided nerves could cicatrize and recover their functions temporarily absent. In old observations, the return of innervation, to insensibilized or paralyzed regions after a traumatic lesion, had been observed only after quite a long time. This was explained by the admission of nervous regenerations; but no proofs were given to sustain this admission. In 1867, Richet, watching a case of section of the median nerve, observed that sensibility remained in the tissue animated by the divided nerve. A plausible explanation of the fact was looked for, when Arloing and Tripier gave it the true interpretation.

Veterinarians have for a long time noticed that plantar neurotomy made above the fetlock, on one side only, did not result in the complete anesthesia of the corresponding half of the foot. Moorcroft, who had made this remark, explained it by the *functional solidarity* of the *plantar nerves*, by a kind of nervous assistance. Arloing and Tripier have shown that after the section of a nervous branch, the sensibility remained attenuated in the region animated by this branch, thanks to the recurrent fibres that each nerve mutually exchanges with other nerves. At the point of division, there are numerous anastomosis; nervous threads belonging to a given branch, return to one or more branches close by, where they mingle, to go and terminate further on. After the section of a nerve,

while the direct fibres degenerate at the peripherical end, the recurrent fibres remain intact and keep up a certain sensibility in a region which was supposed entirely anesthetized. The theory of preserved sensibility took the place temporarily of that of the returned sensibility and for a time nervous regeneration was considered as the appanage of youth. It is scarcely ten years since a most distinguished surgeon contested again the regeneration of nerves, and affirmed that, even in making the suture of both ends, the nervous current was unable to pass through the cicatrix. He said, if sensibility is not entirely abolished, the fact is due to collateral roads, and as motor nerves have none, motility is, in general, extinct without possibility of return, by their division.

Some time later nervous regeneration was definitely established by numerous observations and experimental researches.

How does it take place?

When a nerve has been divided, the peripheric end loses its properties. In each interannular segment, at the same time that the nucleus lying against the sheath of Schwann swells and proliferates, the myeline breaks it on its external face, on a level with each incision of Lantermann, and is thus divided into balls. The cylindraxis, affected by the nuclear proliferation, is in its turn indented and thousands of times cut alongside the degenerating fibres; soon it disappears, as well as the myeline, which is resorbed. The sheath of Schwann is then filled with protoplasm and nuclei; later, these last elements atrophy, the protoplasm in its turn is resorbed and of the nervous thread there remains but empty sheaths of Schwann, plicated, lost in the middle of a fibro-fatty tissue. This change is general and absolute—with exception for the recurrent fibres—and if regeneration takes place, the cylindraxis must be rebuilt entirely.

Curious modifications occur in the central end, which do not extend beyond the first annular contraction. In this short portion, the nuclei proliferate, the myeline breaks up. There, a round or ovoid swelling (central bulb of the neuroma of regeneration) is formed, grayish-white in color, adherent to the surrounding tissues, encysted in a cicatricial mass and united to the peripheric end by an intermediate tractus (cicatricial segment) which serves as conductor to the regeneration. The cylindraxis, instead of undergoing regressive changes, as in the peripheric end, become the seat of a special constituting activity; except those belonging to recurrent fibres on the road to destruction, these cylindraxis granulate at the point of the first contraction, from which start myeline tubes which ramify in the neuroma of generation. A single cylinder may give twenty, thirty, forty of these tubes, which may be very irregularly arranged, entangled, running through a thick conjunctive mass.

When the ends of the divided nerve are united or close to each other,

the young fibres run through the cicatricial bridge thrown between them, reach the peripheric segment, penetrate into the sheath of Schwann or mingle together, and many of them instill together as far as the limits of the degenerated nerve, which is thus reconstituted. If these ends are separated by a cicatricial structure of a certain length, regeneration still takes place, providing, however, that the distance does not exceed 6 or 7 centimeters. It is so much more easy and complete that the interfragmentary cicatrix is more recent and shorter. It can not reach the periphery except by a conductor, and of course it must be admitted that many new-formed fibres are lost, degenerate, disappear; others stop in their way; those that reach the periphery—the useful fibres—are but a small portion of the elements born from the central end. At any rate, regeneration is always incomplete; the new nerve is far from having inherited, in the same degree as the old one, properties of sensitive and motive branches.

Some surgeons have recently mentioned cases in which sensibility returned in some regions, immediately after bringing in contact the ends of the divided nerve distributed in those regions (Tillaux, Nicaise, Polaillon, Segond, Berger). This fact has been explained by *recurrence*, *assistance*, *arrest of inhibition* or *dynamogeny;* but it is difficult to give of it a satisfactory interpretation, with the actual data of physiology.[1]

It has been demonstrated that divided cylindraxis never unite again to others; there is always between them a fibrous cicatricial tissue, even in cases where immediate reunion has been obtained; the preparations of Quénu prove it abundantly. The suture, performed early, cannot prevent the degeneration of the peripheric end. *A fortiori*, when the division is old, the most perfect suture will not permit the immediate passage of the nervous current; for this, the peripheric end, "true cadaver," must be reanimated by regenerating from the centre to the periphery. Like anatomical repair, the functional remains very imperfect.

The duration of the regeneration varies according to age, the height to which the nerve is divided, and whether there has been simple division or excision. It varies generally between five and six months.

These data are sufficient to understand, better than with all proposed explanations, why the sensibility remains indefinitely reduced in the regions placed under the influence of nervous branches which have been divided or resected and why some lameness does not return, after neurotomy, notwithstanding the regeneration of the divided nerve.

If the removal of the nervous influence does not seem to exercise a visible immediate action upon the intimate phenomena of nutrition, it may bring on lesions with rapid or slow development, inflammatory or gangren-

[1] Berger, Laborde, Lifort, *Bulletin de l'Académie de Médecine*, Paris, 1893, pp. 293, 313, 355, 450.

ous in nature, hypertrophical or atrophical, specially when other causes occur ulteriorly, some of which are known—traumatisms, infections—and others remain unknown. In the field of distribution of a divided nerve, no organ or tissue is surely exempt from it. They have been observed, specially in the skin, cellular tissues, tendons, bones and articulations. Their mode of production is only imperfectly known, but in animals, no more than in man, subsequent traumatisms do not seem necessary to their production. On this point, clinical observation and experimentation agree. If, says Lancereaux, the production of lesions "is assisted by a traumatism or any irritation of the tissues, it must be acknowledged that this circumstance is not absolutely necessary and that some times gangrene occurs entirely without any special occasional cause." Quite recently, in a horse upon which, two years ago, we had divided the external plantar nerve above the fetlock, we have seen appear, without any traumatism, serious lesions which condemned him to be destroyed. Brown-Séquard and other observers, who have studied the effects of the section of the sciatic nerve, have not always seen the leg remaining *indemne*, as some pretend; in several animals, they have seen numerous trophical troubles, specially gangrene of the extremity and sloughing of the phalanges.

The *compression* of nerves has causes whose action is either sudden or slow. One understands that the evolution of the troubles will differ whether the compression is produced severely at once in the middle of a traumatic center or realized gradually by a neoplasm developing in proximity of a nervous cord. On animals kept in decubital position for a long time, specially when a leg is secured in crossed position, a more or less complete impotency of the displaced leg is sometimes observed, due as it is to the compression of the brachial plexus between the arm and the trunk. After some dystokias, when powerful tractions have been made to remove a fœtus of abnormal size, out of proportion with the dimensions of the canal through which it has to pass, one may frequently observe, in the cow especially, a lameness due to compression of the obturator nerve (see *Paralysis*). Accidents of similar order brought on by the compression of the gluteal nerve or of the great femoro-poplitial, have been observed.

The application of cords and hooks may produce, in the fœtus, various paralysis yet little studied. Traumatic lesions, inflammatory exudates, large cicatrices, tumors, exostosis are as many causes of compression of nerves. At the post-mortem of a horse, affected with incurable lameness, Rigot found, at the point of insertion of the tendon common to the great dorsal and the long adductor of the arm, an irregular exostosis, which had injured some of the nerves of the brachial plexus; "the neurilemna and pulp of these nerves was of a dark-wine color." When the com-

pression is great or continued for a long time, the lesions consist in degeneration of the nervous cord and the paralysis of the region where it is distributed.

Paralysis from casting will be avoided by not keeping the animal too long down, specially when the anterior leg of the side on which he lies is fixed in crossed position. In difficult accouchements, the fœtus must be displaced and put in good position to facilitate its exit and avoid all nervous lesion of the pelvis.

The treatment of compressions of traumatic nature and of paralysis resulting from it, is that of nervous contusions: rest and irritating frictions on the affected muscles. If these atrophy, blisters, cauterization, exercise are the most recommended agents.

Some paralysis due to the compression of a nerve by a bony callus demand that it should be isolated from it. After the incision of the skin and tissues underneath, the nerve is liberated by the aid of the gouge and mallet, acting with a great deal of care. The nerve disengaged, the muscles recuperate their functions and return by degrees to their physiological condition. The ablation of a large cicatrix or of a tumor may also remove troubles produced by compression of the nerves in its neighborhood.

Contusions of nerves result from external (blows, knocks, falls) or from internal causes (luxations, fractures). They are observed generally on nerves that are little protected. The facial, on account of its superficial situation, is the most frequently affected. In the legs, nervous trunks, situated rather deep in the greatest part of their course, are rarely injured by traumatisms.

The lesions made vary according to the severity of the cause; at times there is only a slight bloody extravasation between the tubes and rupture of some of them; at others the bloody infiltration extends in the nervous cord, far from the contused point; in serious cases, there is crushing of the nerve, rupture of its fibres, distension of the sheath by a reddish pulp. Whatever may be the degree and extent of these lesions, the neurilemma is intact or very little altered. The divided nervous tubes undergo the wallerian degeneration in their peripherical end, and when the nerve is entirely crushed, the recurrent fibres alone escape destruction. These disorders are characterized by sharp pain at the injured spot, which sometimes extends alongside the nervous trunk, and by a more or less complete paralysis of the sensibility and motion.

Rest is the first indication common to all the cases. Besides, the resorption of the exudate should be stimulated so as to relieve the nervous element and prevent neuritis. Antiphlogistics, massage, then stimulating and blistering applications are ordinarily used. The administration of iodide of potassium internally is advantageous. The paralysis of all the

muscular groups where the contused nerve is distributed sometimes remains.

After being considered for a long time as absolutely harmless, *ligature of nerves* is accused of serious accidents. Now, it is known that it cannot give rise to tetanus, but it produces acute pains, neuritis, paralysis; on that account isolation of nerves during operation is essential. If an artery is to be ligated, the surrounding nerves must be respected. The close relations of the pneumo-gastric, sympathetic and recurrent with the carotid are known: it is useless to insist on the danger of constriction of these important branches. In the rare amputations that we have made, the nerves were always isolated and divided a little higher than the other tissues.

Ligature of nervous branches gives rise to active reactions. If it has been done accidentally, the ligature must be cut immediately and the nerve carefully isolated from the tissues which are to be ligated.

Though nerves enjoy a great elasticity, they are exposed to *stretching*, *tearing* and *pulling*. Luxations, fractures with displacement, callus, tumors of large size, violent mechanical or traumatic actions may produce in nerves lesions varying from the simple distension to complete tearing. In the celebrated stallion *Physician*, affected with a fracture of the forearm, the cubito-plantar and cubito-cutaneous nerves were found lacerated by the fragments of bones and inflammed in two-thirds of the extent of the forearm. Under the influence of mechanical or traumatic influences of equal violence, arteries and veins give away before nervous cords do. In these, the nervous tubes break up first, the neurilemma stretches like the external coat of arteries. The pulling of sensitive nerves gives rise to pain, to which succeeds anesthesia in the field of distribution of the involved nerve. With motor nerves, the same cause brings on paralysis. The artificial pulling of nerves has been tried in man, to overcome some painful affection. Trials of this kind, made on horses, have given results inferior to those obtained by neurotomy.

Ordinarily in simple stretching, after having attended to the cause (reduction of luxations, of fractures, removal of a tumor, partial resection of a callus) sensibility and motricity reappear. Revulsives may usefully overcome the consecutive disturbances. Complete pulling generally goes with such serious lesions that the killing of the patient imposes itself. Amputation of the leg or suture of the nerve are the means to use in small species.

Nerves may be the seat of *pricks*, *cuts*, *contused* or *gunshot wounds*. We are lacking clinical documents upon simple pricks of nerves in animals. Notwithstanding the small size of the wounding body, a few fibers are always divided: a "bloody sub-neurilematic or interfascicular suffusion" takes place, producing only slight troubles.

Complete accidental sections are met with wounds made on the course of nerves. In contused or torn wounds, the nerve is flattened or stretched, and as its resistance is greater than that of arteries and veins, it generally gives away only after them. Projectiles may perforate, cut or even tear off a piece of a nerve.

Nerves are retractile like arteries; after their section, both ends separate; to favor the repair of the organ, it is indicated to apply suture of the nerve. The atrophy of the peripherical end is unavoidable; even with the most perfect suture, a cicatricial septum is always formed. It is not doubtful that sensibility and mobility may last or suddenly reappear a few days even a few hours after suture; but, as we have said, this must be explained otherwise than by the immediate reunion of the cylindraxis. However, clinical and experimental results justify the suture of nerves, and the operation must always be done early. Although it has been performed but little in our animals, there are, however, indications for its use. In valuable animals, specially those of small species, it must be employed. Möller has with complete success sutured in the dog the tibial nerve accidentally cut.

Here is the mode of doing it:

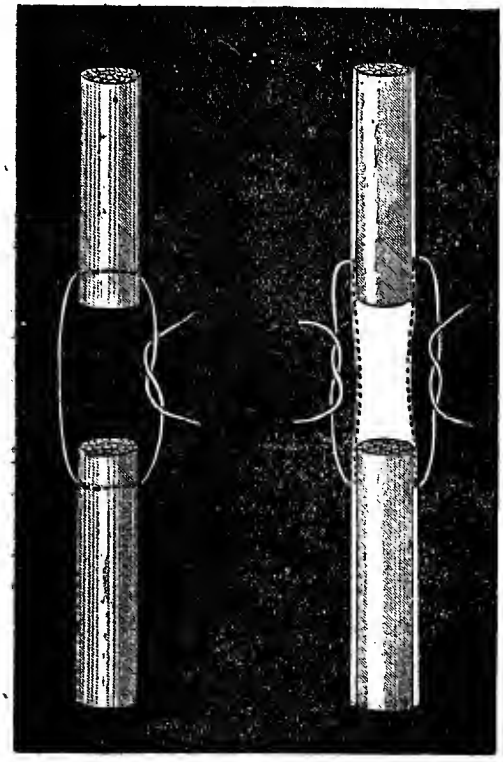
Assisted by his anatomical knowledge and armed with the necessary instruments (bulldog forceps, scissors, bistouris, catgut threads, fine needles), the operator should expose both nervous ends. In recent wounds, he will find them with their normal characters; their ragged ends should be smoothed over with the bistouri. In old wounds, the extremities are swollen, adherent to the surrounding vessels and united by a more or less solid structure; they must be slightly excised to bring in contact two fresh cuts. For the reunion, several ways offer themselves. A *direct suture* may be made by passing the thread in both stumps); the upper piece is first pierced through from forward backwards, at one or one and one-half centimeters from the cut, then the needle is made to pass through the other stump, this time, from backward forwards. In *the perineurotic indirect suture* the thread passes in the neurilematic envelop; two stitches are sufficient to insure the coaptation, but often the sheath slips, tears, and it is then very imperfect. The *paraneurotic suture* does not involve the neurilemma; it only encloses the surrounding connective tissue. Some surgeons apply four stitches, placed on the four sides of the nervous cords and including the sheath and the superficial fibres of the nerve itself (Berger).

By using fine antiseptic thread (catgut or silk) and a needle of small caliber, the nervous cords stand well the direct suture. The peripherical end is held with the forceps, taking the neurilemma only; it is run through with the needle and then the other end is secured. A knot regularly tied permits the perfect coaptation. The essential is to pass the threads near the

divided surfaces, so as to avoid the angular deviation of the united extremities.

Such interferences are to be completed with an antiseptic dressing and immobilization of the leg or its fixation in such a position that the stretching of the nerve shall be as slight as possible,—a condition which is sometimes difficult to obtain with animals.

If it has been necessary to cut off a small piece of the extremities of



SUTURE OF NERVES.

Fig. 90.—Direct suture. Fig. 91.—Perineurotic suture.

the nerve, it is sometimes impossible to bring the nervous stumps in contact. In such a case, the suture apart (at distance) with catgut threads and under most rigorous antisepsy is the preferred mode of operation. The leg placed in good position, peri and paraneurotic stitches will be applied to reduce as much as possible the separation of the stumps; some direct points may also be made. It is rational to admit that the resortable threads act as guides to the young afferent neuricles of the central end, and prevent them from going astray (Forgue and Reclus).

Regeneration of nerves is slow. In general, as we have said before, the sensibility and motricity do not return for several months.

In relation to the nerves that are incompletely divided, their complete section is no longer demanded. Consolidate the union of the two ends with a stitch, immobilize the part under an antiseptic dressing, is the indication to follow.

II.

NEURITIS.

In man, simple contusions, burns, frost-bites, bony or articular inflammations, tumors, not infrequently give rise to *neuritis*. These are *interstitial* or *parenchymatous*, *acute* or *chronic*, *descending* or *ascending*.

These last, in which are several groups, are yet badly known. In the preceding chapter we have seen that the section of a nervous branch is followed with degeneration of the peripheric end and that it has no noticeable influence on the central stump. In *ascending neuritis*, there takes place in the central end, either a process similar to the wallerian degeneration (parenchymatous neuritis) or an inflammation of the perifascicular connective tissue, the lamellar envelop or the interfascicular connective tissue; or again, the inflammation, both parenchymatous and interstitial, of the nerve. Some troubles *at a distance* (paralysis, anesthesia, amyotrophy) are explained by an ascending neuritis extending to the spinal marrow.

For animals, if neuritis may complicate traumatic lesions of nerves, it is rare, and experimental studies have added nothing to the very incomplete data given by clinical observation.

"I have tied nerves in ligatures more or less firmly," says Vulpian. "I have squeezed them between two hard bodies, cauterized with various substances (cantharidine, liquid ammonia, acetic acid), pierced them with needles, without ever obtaining a true suppurative neuritis, beyond the points submitted to the experimental violence."[1] Charcot tells us also that experimental lesions, even the most serious, of the peripheric nerves, produce with difficulty, in most animals, a neuritis of some duration and like that which is developed, on the contrary, so easily in man after the slightest lesions.[2]

Whatever may be the special resistance of animals to the inflammation of nerves, pricks with crushing of the tubes, contused wounds or those made by foreign bodies, expose them more than clean sections. After the operation of neurotomy, when the wound has suppurated, sometimes a

[1] Weir Mitchell. *Des lésions des nerfs*—Préface de Vulpian, p. XI.
[2] Charcot. *Lésions sur les maladies du système nerveux*, p. 13.

defective cicatrization takes place with formation of a large cicatricial tissue, painful, producing lameness: it is a plantar neuritis, which always remains limited. This neuritis and a pseudo-neuritis may be observed on both ends of a neurotomized leg, even on both legs. It seems as if some subjects are predisposed to them. As for other tumors of nerves, ablation is followed by the removal of the lameness. Neurotomy performed above the neuritic portion has therefore its indications.

In bovines, Gellé has described neuritis (?) of the branches which supply the external face of the shoulder. Due to pricks of the pointed instrument which their driver uses as a whip, the sensibility would remain but motricity disappear, and back of the acromion, at its lower portion, a subcutaneous tumor, as big as a large pea, was observed. At the onset, Cruzel recommends long affusions of cold water, soothing unctions of althea ointment, camphorated or opiate populeum; then, after a few days, frictions of spirit of turpentine. Soon improvement becomes manifest; regular exercise completes the recovery.

Besides traumatic neuritis, toxic or infectious types are met in animals. In horses, neuritis of the recurrent has been observed during lead intoxications. In cattle, after endometritis and peritonitis, Hamburger has observed neuritis of the median and of the crural. In the course of some infections, polyneuritis with muscular pains and sometimes subcutaneous ademas resembling polymyositis, may occur. Polyneuritis *a frigore* seem rarer than polymyositis of the same nature; but in hemoglobinuria, it seems that besides polymyositis there are often polyneuritis, as the paralysis, anesthesia and rapid consecutive amyotrophy have a tendency to prove. The differential diagnosis is specially based upon the normal or painful state of the nervous cords of the affected surface. In polyneuritis, compressions exercised upon the course of nerves give rise to acute pains; the same compressions are but little painful in polymyositis.

It is to this variety of neuritis that must be added the alterations, so often observed in the femoral nerve, after "paraplegia." Goubaux has described them wrongly under the name of "neuromas" of the femoral. In reading the observations related by this author, it is seen that they affect animals suffering first with "paraplegia" or "hemoglobinuria" and which remain lame on one hind leg. In all, he mentions the atrophy of the triceps cruralis. In Observation I, it is said: "The anterior femoral nerve was of a larger dimension than that of the opposite side; it presented in the middle of its extent a swelling, as big as a hazel-nut, grayish red in color; in the middle of which the nervous fibres appear larger and with the cellular tissue surrounding infiltrated with serosity." And in Observation II: "The anterior femoral nerve, at the place where it comes out of the pelvic cavity to ramify in the muscles, presented an elongated

swelling, hard, of a grayish red color." These are the lesions of the post-hemoglobinuric femoral neuritis.

Trasbot has thus described the alterations of the nerve when the affection is recent: "Its interfascicular connective tissue, extensively injected with blood, has a dark red color. Little by little this same tissue, partaking of the inflammation developed as consequence of the surrounding traumatism, vascularizes and swells; the nerve, upon a length of five or ten centimeters, presents then a fusiform swelling, whose transverse diameter may, in its middle part, be two or three times the primitive size, which is preserved before and beyond the swelling. By simple dissection, it is observed that the nervous cords are isolated from each other, individually enveloped and compressed by the embryoplastic tissue now in process of formation." The treatment of this affection shall be indicated in the chapter on *Paralysis of the Femoral Nerve.*

The therapeutics of neuritis varies with its forms. Prevent the cause is one of the first indications. For instance, by taking the precautions insuring immediate cicatrization, one will have great chances to prevent neuritis of operation; and if neurotomy is performed, by cutting the nerve as high as possible, near the superior angle of the incision. With toxic or infectious neuritis, the introduction in the organisms of nocive agents should be guarded against, their elimination favored, or antitoxic agents resorted to to overcome their influence. When already neuritis is of some duration, the restoration of the nerve by hydrotherapy, electrotherapy (faradic or galvanic), massage and exercise will be indicated. Rheumatismal neuritis should be treated by salicylate of soda. Overwork and cold should be avoided.

III.

NEUROMAS—TUMORS.

Most of the authors that have treated of neuromas have placed under that denomination all the tumors developed on the course of nerves. But only the rare neoplasms formed by nervous tissue of new formation deserve this denomination; the others are only fibromas, myxomas or lipomas of nerves. The painful products found at the extremity of nerves in some stumps of amputations are not neuromas; neither are the pseudo-tumors which fill up the wounds of neurotomy, no more than the callus or the cicatrixes of the tendons represent true neoplasms: they are the result of the inflammation of the nerve and belong to neuritis. The same exists for the post-hemoglobinuric "neuromas."

Let us remark that in the generality of the cases published in veterinary medicine, histological examination has not been made. From the therapeutical point of view, the true nature of these tumors is indeed of secondary

importance, and whether it is for pseudo-neuromas, fibromas, myxomas, or, on the contrary, true neuromas, the treatment is the same.

Rigot has several times found in the metacarpal or metatarsal regions, upon the course of plantar nerves, circumscribed nodosities, hard, varying in size from that of a bean to that of a pigeon's egg. Small, they were moveable under the skin; large, they had contracted with it intimate adhesions. Very painful to pressure, they gave rise to lameness. The author describes them as follows: "They are composed of a very hard white substance, by which the nervous threads are separated and pushed outwards, and spread round the tumor, flattened as little bands. In other cases, this scirrhous substance entirely surrounds the nerve, compresses it and forms with it an homogenous mass; and again, in two of these tumors, the largest I have ever seen, I have found in their center a cavity containing a gelatiniform substance, mixed with a very small quantity of blood."[1]

Rey, Delwart, Lafosse, have reported also examples of "neuromas" or "tumors" developed upon nervous cords.

What is the proper interference to use against these alterations, called in old times "ganglions of nerves?" Rigot and Lafosse have tried, in vain, alteratives, compression and actual cauterization. Iodide of potassium is without action. Excision is the only treatment that has been successful. A horse lame for two months on the left foreleg was operated by Rigot; there was "on the course of the external plantar a tumor as big as a large bean, very hard, moveable, painful to pressure of the thumb." The animal was cast and the leg placed in proper position. The skin incised, the tumor and the nerve were exposed upon a certain length. The neoplasm was excised with the scissors. Immediately after the operation the lameness disappeared. The wound healed rapidly.

Lafosse found also on the inter plantar of one anterior leg a tumor, whose characters resembled those of fibromas due to the spiropterus reticulus: "The tumor had pushed forward the nerve, which was intact, except on its posterior border. It was composed of a fibrous tissue incrusted with small yellowish masses, hard, stone-like, similar to the tuberculous deposits so common in cattle."

Interference varies in its details according to the more or less intimate connection of the nerve with the neoplasm. When the diseased nerve is small, it is excised; but when it is an important trunk, it is possible to preserve it if the tumor is pedunculated, hanging to the nerve and resting on it, as in the case of Lafosse. When the tumor is central, surrounded by flattened nervous filaments, one might, under anesthesia, incise the nerve, and enucleate the neoplasm in preserving intact the con-

[1] Rigot, *Rec. de Med. Vet.*, 1829, p. 462.

tinuity of the organ. If the tumor envelops the nerve entirely, it is excised on one of its faces and each half removed one after the other. At times the nervous filaments and the neoplasm are intimately entangled; the separation is impossible; the whole mass must be excised.

For painful cicatricial parts which succeed neurotomy, excision is the most efficacious treatment. The central end of the nerve is isolated, and separated on a healthy portion; the neoformed fibrous product is then dissected. It is ordinarily found intimately adherent to the tissues underneath. Trasbot has thus removed a tumor in a horse, whose size was about that of the small finger; its tissue was white, slightly grayish, very firm and hard like fibrous tissue; the nervous threads run through it separated, leaving between them quite thick layers of that tissue.

Neuromas of stumps of extremities are also treated by ablation.

The generalized neuromas, which transform the nerves in true bead-roll of tumors, are seen only in cattle (Colin, Morot). The cow of Colin had shown no ailment during life; at the post-mortem, tumors were found in the brachial plexus and in all the sympathetic system. At the lumbar region, they formed a mass weighing five pounds. The pneumogastrics, cervical and subcostal threads of the sympathetic, the inferior cervical ganglions and several nerves of the head had isolated tumors of all sizes, varying from that of a pin to that of a goose's egg. From the observations of Morot, it seems certain that these neoplasms, are not rare in bovines. During 1885, this author found them in eleven cows; two of them had more than 120, one more than 100 and two more than 80. The nerves of the dorsal, costal and sternal regions, as well as those of the legs and of the posterior parts of the neck, were affected. The situation of these tumors is most variable: "Some, situated directly under the neurilemma, are visible by transparency. The others are difficult to be seen, being imbedded among the central nervous threads. By exploration of the course of the nerves, they are readily perceived, rolling more or less under the fingers."

It is surprising that such extensive alterations of the most sensitive tissue of the organism should remain absolutely silent. As Tillaux remarks, in man, if pain was proportional to the number of the neoplasms, life would be unbearable with such etherism of the nervous system. But as much as solitary neuromas are painful, as much those bead-rolls of tumors seem compatible with the regular execution of all functions. If lameness or manifest pains would occur and that interference would be desirable on valuable animals, this would be guided by the results obtained in man. Bromide of potassium has proved advantageous (Nicaise); aconite, antipyrine, salicylate of sodæ has given good results. Only the large neuromas producing pain exceptionally may necessitate extirpation.

IV.

NEURALGIAS.

Pains situated along the course of nerves most commonly result from congestion, compression or inflammation of these organs; but sometimes they show themselves without any apparent alteration having taken place in the nerves. Neuralgias then represent a syndrome related to several processes; some well known, with manifest lesions of the painful nerve; others of nature yet unknown. Hence, the division into *neuritic-neuralgias* and *neuroses-neuralgias*. In animals, more or less acute pains, due to nervous lesion, are commonly observed. By analogy to what takes place in man, animals are also subjects to *neuroses-neuralgias*. The *facial neuralgia* would produce a kind of "symptomatic ophthalmia with redness, tears flowing and photophobia, a little nasal discharge and ptyalism. The horse has the eyes staring and brilliant, he moves his ears, lays them back as a vicious animal, bends his head towards his leg, and manifests his pains by groans analogous to that seen in animals on which a twitch is applied, and by kicks against his stall" (Renner). *Sciatic* or *femoro-popliteal neuralgia* is accompained "by shakings and lameness of the affected leg; moving and exercise increase the pains, specially when the foot rests on the ground..... Sometimes, as characteristic in animals, tremblings of muscles have been observed, giving rise to access of pains; also weakness of the leg, which is half paralyzed....." (Zundel). *Cervico-brachial neuralgia* is accompanied by a continued or intermittent lameness with painful spots on the course of the nerves. Descriptions have been given of a *cervico-occipital neuralgia*, which may be mistaken with torticolis—a *dorso-intercostal neuralgia*, with pains during respiration;—a *lumbo-abdominal neuralgia*, with pains in the loins. Zundel speaks also of neuralgias of the mammæ and of the testicles. Möller has several times observed the hyperesthesia of some cutaneous regions, without material lesions or marked alterations. He considers as neuralgic in nature the intermittent hyperesthesia of the poll and of the withers, brought on by frictions of the harness and which is increased by the slightest pressure. He says he has observed frequently neuralgias in the surface of distribution of the occipital nerve.

In some of the cases of femoro-popliteal or sciatic neuralgia related in horses, cattle, goats, the nature of the affection is at least doubtful. The same can be said of the *brachial neuralgia* of Cantoni and of most of the observations of this kind.

It goes of itself that the diagnosis of "neuralgia" must be made in

animals with a great deal of reserve and after repeated examinations, in dogs especially, where rheumatic pains are very common, and might be taken for neuralgia.

Neuralgia is treated by local means and internal medication. Soothing compounds and antispasmodics, specially bromide of potassium, valerian, asafetida, camphor, opium, belladonna, aconite, have been tried. To-day morphine injections, antipyrine, cocaine, hold the lead in anti-neuralgic medication.

Upon the course of the supposed diseased nerve, cataplasms, oils of hyoscyamus, of belladonna, blisters, points of firing, subcutaneous local injections of morphine and atropine, are useful. Some authors recommend massage, acupuncture, electricity. Sometimes the general condition of the patient must be looked after. Anemic animals should receive iron and quinine; rheumatic patients, salicylate of soda.

Against some rebel neuralgias, more active treatment is required. Two methods are left to the surgeon's choice; *stretching of the nerve* and *neurotomy*. The first diminishes the transmission of sensibility of the nerve without changing the motility. On the contrary, neurotomy suppresses all nervous current, and if it is completed by neurectomy (removal of a piece of it), the regeneration of the nerve is more or less postponed and therefore also the reappearance of the sensibility. These two rival modes are not judged yet by veterinarians. However, neurotomy is more familiar to them, and it is used for many painful conditions that have remained rebel to ordinary therapeutic agents.

V.

PARALYSIS.

Under this name or that of *akinesia* is understood the abolition or diminution of the contractility of muscles through their normal stimulant. The simple diminution of muscular contractility is sometimes designated under the name of *paresy*. The loss of sensibility to pain or to touch (*analgesy* and *anesthesy*) often exist with akinesia and furnishes important elements of diagnosis. We have spoken of *myopathic paralysis* in studying the diseases of muscles; we will here treat only of the *neuropathic paralysis*.

They present themselves under very varying forms, among which are: 1st, *local* or *isolated paralysis*, involving one or several muscles of the same group, sometimes several muscular groups; 2d, *monoplegia* or *paralysis involving a whole leg*, and of cerebral or spinal origin; 3d, *hemiplegia* or *paralysis of one lateral half of the trunk;* 4th, *paraplegia* or *paralysis of the hind quarters;* 5th, *associated paralysis;* 6th, *diaplegia* or *diffused paralysis*.

At times the paralyzed muscles are flabby and relaxed; if it is in one leg, one can move it in all directions without the slightest resistance (*flaccid* or *relaxed paralysis*); at others, but less commonly, the muscles are stiff, contracted (*spastic paralysis.*)

Neuropathic paralysis are only symptoms common to various lesions of the brain, of the cord or of the nerves. To treat them rationally, it is necessary to determine the seat as well as the lesion of the existing lesions. There are cases where the impossibility of standing (paraplegia), the lameness (paralysis of the femoral), the mode of carrying the leg (paralysis of the radial), the aspect of the region (paralysis of the facial) immediately give information. But in others, the diagnosis is difficult. The *sensibility*, the *reflexes*, the *electric contractility* may give valuable assistance.

The *sensibility* may be increased, diminished or perverted. In animals, general sensibility is tested by pricking or burning. Generally the diminution of sensibility is located on the same side as the paralysis; yet hemiplegia can exist on one side and hemianesthesia on the other. The examination of special sensations (hearing, sight, smell) is also very important. Difference in the pupils, myosis, mydriasis, absence of pupillar changes by light, indicate lesions of the encephalon, cervical cord or sympathetic.

Tendinous reflexes (patellar reflex, that of the tendo-achillis) are normal, exaggerated, diminished or suppressed. Their mechanism is known: the mechanical irritation, carried to the gray substance of the cord by the centripetal fibres and the posterior medullar roots, is propagated to the motrice cells of the anterior horns of the cord, where it is transmitted to the muscles by the peripheric motrice ways. The integrity of the "spinal reflex current" is the condition of the presence, in the normal state, of tendinous reflexes. They are diminished or abolished with lesions involving the centripetal or centrifugal nervous fibres, or the anterior or posterior roots of the marrow, or again the gray medullary substance. And as there exists in the encephalon and the superior layers of the cord, *moderating centers* of these reflexes, one may understand how the lesions, which involve the brain and the anterior half of the cord and suppress the influence of these centers upon the inferior regions of the spinal marrow, may produce an exaggeration of these reflexes. That is what occurs in many circumscribed medullary affections, which leave intact the reflex spinal arch.

Electric exploration (faradization or *galvanization)* gives also useful indications. The electric muscular contractility is preserved in paralysis with cerebral origin and in some paralysis with spinal origin (when the segment of the cord, which innerves the paralyzed muscles, is *in-*

demne); it is abolished in spinal paralysis with disorganization of the medullary segment corresponding to the paralyzed muscles, and in traumatic peripheric paralysis, *a frigore* or toxic (reaction of degeneration.) The lasting abolition of electric contractility of paralyzed muscles is an indication for bad prognosis. It coincides with the loss of the reflexes and is soon accompanied with the atrophy of the affected muscles.

Let us resume the principal characters of *paralysis with cerebral origin*, of those with *medullary origin*, and of those with *peripheric nervous origin.*

In general, in *cerebral paralysis*, there is *hemiplegia of the opposite side of the lesion*, and the cranial symptoms allow us to differentiate the cerebral from the spinal hemiplegia. Ordinarily the sensibility is preserved; when there is anesthesia, it is hemiplegic and is situated on the same side as the motrice paralysis. Bilateral alterations of the brain and those of the mesocephalon may produce paraplegia. Lesions of the cortical layer of the brain give rise to various paralysis; motrice fibres having their origin in the gray substance of the cerebral cortical portion and the psychomotors being independent, autonomous, if the cortical lesions are circumscribed they only give rise to monoplegia or local paralysis. But, here again, the encephalic symptoms often allow a positive diagnosis. Some paralysis of encephalic origin are *alternate;* the face is paralyzed on the side of the lesion; the legs on the opposite side—a peculiarity due to the *bulbar decussation* of the pyramidal fasciculi, which transmit the will of the motrice regions of the brain to the different sections of the spinal cord. An encephalic morbid center which is, for *cranian nerves, a peripheric lesion* and involves the pyramids *above their decussation*, promotes a *crossed paralysis* or *alternate hemiplegia.* The typical paralysis of the annular protuberance is the alternate hemiplegia; that of the bulb, the labio-glosso-pharyngeal paralysis.

Paralysis of medullary origin are almost always ordinary paraplegia, limited to the posterior legs; sometimes the anterior are also affected (cervical paraplegia). In the cord, the ways of conduction being very near each other, lesions, even small, produce easily those bilateral paralysis; but very limited alterations may give rise to hemiplegia or monoplegia, then the suppression of the motility is always direct. The troubles of sensibility are various; in general, anesthesia is paraplegic; if it is hemiplegic, it is situated on the opposite side to the lesion: at times anesthesia is only in spots. When the cord is destroyed in all its thickness, reflexes which have their center below the region are exaggerated. Muscular atrophy is frequent. Some characters permit also to recognize the localization of the lesion upon the cords or upon the gray substance. The alterations of this last give rise to paraplegia, all reflexes corresponding to the diseased

region have disappeared, the atrophy of muscles is rapid, there is diminution of the electric excitability and reaction of degeneration partial or complete in the paralyzed structures.

Paralysis of peripheric nervous origin—the ones that we have particularly in view—are generally limited to a single nerve or to a group of nerves in the neighborhood, and rarely do they involve a great number of muscles. At the same time that the paralysis of motion, anesthesia and trophical disturbances are observed, ordinarily precocious, which little by little become more marked, reflex excitability is destroyed. Electric exploration is not slow in giving the reaction of degeneration.[1]

To establish a rational treatment of akinesia, the nature of the lesion and cause of it must be known. Ischemia and congestion, hemorrhage, softening, acute or chronic inflammation, tumors, various infections or intoxications, are as many morbid processes liable to act on the nervous system and promote paralysis very variable in their seat and in their march. *Paralysis occurring rapidly* are due to mechanical, toxic or infectious causes, according to the cases: nervous compression, cerebral or medullary hemorrhage, intoxication by vegetal or mineral poisons, infection and intoxications by microbian poisons. *Paralysis progressing slowly* announce a chronic inflammation or a neoplasm.

In the chapter *Diseases of the Brain and Cord* we will come back on the paralysis of cerebral and those of spinal origin. Several *local paralysis* will be studied with other affections of the regions where they are met. We will here consider specially the *akinesia* of extremities.

From what has been said above it is seen that *local paralysis* are ordinarily determined by various causes which abolish the functions of a nerve by destroying its continuity or altering its structure: by section, compression, distension, laceration of the nervous branches, neuritis and neuromas. It is sometimes difficult to learn their precise nature. Some are of infectious or toxic origin. Often paralysis of unknown origin are attributed to *rheumatism*, when most commonly they are the result of a slip, a fall or perhaps of an infection or intoxication; we hold that truly rheumatismal paralysis or *a frigore* are very rare in all animals. Some are peculiar to some species; we meet with diphteritic paralysis only in aviary species.

According to their origin and the importance of the organs affected,

1 The reaction called *degeneration* is *partial* or *complete*. Specially accused in traumatic paralysis consecutive to the section of a nerve, it has for principal characters: diminution or loss of the excitability of the nervous trunk by faradic and galvanic currents; the persistency or even the exaltation of the galvanic contractility of muscles, in contrast with the diminution or abolition of the faradic contractility; the slowness of the muscular jerking.

local paralysis have a gravity which varies much. The altered, divided nerve, more or less degenerated, may resume its role of conductor, but often recovery is slow. When it is a question of the nerve of legs, and that lameness prevents its utilization, there are cases where treatment cannot be undertaken except for costly animals.

Rheumatismal paralysis are ordinarily benignant. Almost always they disappear in a few weeks. Those due to slight traumatic lesions last sometimes only a few days; serious lesions of same nature bring on paralysis of long duration, sometimes permanent. While the paralysis of the radial nerve recovers almost always, that of the sus-scapular is permanent in most cases. The incurability of the paralysis of the recurrent is explained by the constant compression on the nerve through the hypertrophied glands. The atrophy of the muscles is always a sign of bad prognosis. The persistency of the faradic irritability is a favorable sign: its exaggeration is a sign of early recovery. Incomplete paralysis, specially those of traumatic origin, generally end favorably and in a short time. It is known that most paresis of the radial nerve almost invariably get well in two or three weeks. The older the paralysis is and the atrophy marked, the more serious is the prognosis.

The means of treatment vary with the nature of the trouble. In case of compression by a callus, a tumor, a cicatrix, the sharp instrument must be resorted to. Paralysis that are produced by infiltration in recent traumatic lesions have a natural tendency to diminish by degree and at last disappear by the natural process of the cause. It is indicated to act at the same time on the nerve and on the muscles. When possible, recourse to electrotherapy is indicated, to shorten the duration of the disease as well as to prevent the muscular atrophy. Electricity is a powerful assistant, either by stimulating the nerve or exciting the muscular contractility. The negative pole (cathode) should be placed on the region corresponding to the nervous trunk or on a point where it is most superficial, and the positive pole (anode) upon the muscles where the nerves ramify. The seatings of electrization will last four or five minutes, and will be renewed every day, or from eight to ten minutes, and given every second day. The current should be weak, and strong ones always avoided, as being very painful. Often action is to be limited only on the muscles. The atrophy will be prevented by exercise; massage, blisters, cauterization, subcutaneous injections of veratrin, strychnine, salt-water have proved advantageous. In all cases existing for a short time, iodide of potassium is indicated; it promotes resorption in perineurotic effusions. With rheumatismal paralysis, salicylate of soda will be prescribed.

One must not take for paralysis the *muscular atony* sometimes observed in colts and in calves, in the first days following birth. Most often, the

extensors of the metcarpus and of the phalanges are affected in the fore-legs, and the flexor metatarsi in the hind. Recovery is ordinarily easily obtained by massotherapy, and simple dry frictions.

Local Paralysis of Extremities.

I.—Sus-Scapular Nerve.

The sus-scapular nerve, which ramifies in the antea and postea spinatus muscles, can be injured in various circumstances: by bruises against the shoulder, especially those which occur from forward backward when the leg is raised to be carried forward (Möller) or by a blow, at the time of a fall, or by a slip in abduction. In army horses it has been observed without being able to attribute it to any other cause than powerful muscular efforts or suddenly executed movements. We have observed it after the securing in decubital position. After two months the atrophy of the subspinatus specially was well marked. (Fig. 92.) Under the title of *Laceration of the Tendons of the Subspinatus*, Bouley relates two similar facts. (See *Tendinous Ruptures*.) In some cases, it is rheumatismal in nature or related to hemoglobinuria. For Biot, it is muscular congestion which, giving rise to "hemorrhagic raptus," injures the sus-scapular; the *sweenied* shoulder is but "the consequence of the compression and infiltration of the sus-scapular, by blood extravasated in nature round it and in its structure."

Fig. 92.—Paralysis of the sus-scapular nerve (from a photograph). E, projection formed by the scapular spine; Se, depression due to the atrophy of the postea-spinatus muscle.

This paralysis of the antea and postea spinatus is ordinarily indicated by slight continued lameness, which, at the outset at least, is sometimes difficult to connect with its true cause. At rest, the leg is carried a little forward of the plumb line, the scapulo humeral prominence is carried outward. In walking, the movement of the leg forward is stiff; at the time of putting the foot down, the shoulder angle is more prominent than the other and is carried in abduction. Later, when the atrophy of the sus and sub-spinatus muscles or of this one alone is well accused, the seat of the disease is evident. Then the lameness becomes more manifest after a certain length of work and the animal is unfit for fast work. Goubaux has related an interesting case of paralysis of the sus and subscapular nerves and of the axillary, observed in a horse, which, while galloping, had run against the hub of a truck. The shock brought on an immediate lameness which resisted several treatments. Two months after the accident, the shoulder was thinned, atrophied, the elbow greatly bent outwards with a deviation which increased during walking. At the moment of rest, the weight of the body produced a certain amount of dropping of the extremity. At post-mortem a marked atrophy of the sus and sub-scapular muscles was found, also of the long and short abductors of the arm and of the sub-scapularis.

Recovery occurs in about half of the cases. Möller out of ten observations, obtained three recoveries, three improvements and four failures. Traumatic paralysis implies a more serious prognosis than those of rheumatoid nature. When the atrophy is already great, in general all treatments fail. Revulsive frictions, firing, irritating subcutaneous frictions form the base of the therepeutics. Electricity, used as we have said, may render some service. Hansen says he obtained good results with hypodermic injections of spirits of turpentine. We prefer the subcutaneous injections of veratrine solutions (veratrine 10 centig.; water 5 grams.) According to Goubaux, many have seen this paralysis resist to the firing of the shoulder. But the lameness is slight, and allows the use of the animals at slow work.

II.—Brachial Plexus.

This paralysis is sometimes of encephalic origin; in this case, it is preceded by other troubles, which may appear with it or after. In a horse affected suddenly with paralysis of the right hind leg, and two days later with a paralysis of the anterior corresponding leg, at the autopsy, hemorrhage of the cerebellum was found. Another horse which presented symptoms somewhat similar recovered after three weeks.

Very generally this paralysis is due to local causes: a sub-scapular hemorrhage (Holniann), a deep abscess, a tumor of the internal face of

the shoulder. It often occurs as accident of casting. When one of the anterior extremities remains for a long time in *crossed position*, the plexus may be bruised or compressed between the shoulder and the trunk; when the animal is up, a more or less complete paralysis of the extremity is observed. Almost always it is the leg upon which the animal is lying which is affected; the accident may occur even when the leg has not been displaced. The horse of which Trasbot speaks lay on the right side, and the left anterior leg secured above the corresponding hock; the right foreleg, left in the hobble, was the one which became paralyzed.

According to the degree of the lesions, one will observe a paresis of the leg with tremblings of the olecranon muscles, but these will ordinarily disappear rapidly; at other times, when paralysis is complete, the inert extremity is dragged upon the ground, carrying weight is impossible, the articulations flex under it. The troubles of sensibility are less clear. When motility is abolished, sensibility may yet persist normal or be only diminished.

The treatment must necessarily vary according to the producing cause. Large callous tumors prevent interference. If an abscess develops under the shoulder, in the depth of the axilla, pressing upon the plexus, it must be opened early. A bloody effusion is less dangerous; ordinarily it resorbs by degrees and the leg recovers its motility.

We treat the paralysis of casting by immobilization, stimulating frictions (camphorated alcohol, charge of Lebas, blisters) and by the daily administration of 10 or 20 grammes of iodide of potassium. Irritating subcutaneous injections may be used with advantage. Trasbot's patient was first left alone on a thick bed, but, on account of threatening bed sores, he was placed in slings. The twelfth day, as the fore-leg was improving, general troubles occurred, the right hind leg was paralyzed in its turn; complications due to "ascending neuritis, spread to the spinal cord." Recovery took place, however, rapidly.

III.—Radial Nerve.

The *radial*, or *posterior humeral nerve*, is the largest of the branches of the brachial plexus; it twists around the shoulder joint, reaches the internal of the humerus, its posterior face, then the anterior face of the elbows and that of the radius; it ramifies in the extensors of the fore-arm, those of the metacarpus, the external flexor of the metacarpus and the two extensors of the phalanges. This paralysis has been frequently observed in horses, sometimes in cattle (Harms) and dogs (Möller). We have seen numerous cases in horses and one in dog.

Like the preceding, it is generally due to the securing of horses in

decubital positions; the nerve is squeezed between the thorax and the leg, specially if this one is in crossed position. It may arise from other causes (traumatisms, fractures, tumors). Goubaux accuses falls and contusions; Tondeur has recorded a case due to a kick. Sometimes it arises from strong and repeated contractions of the muscles, which the nerve ramifies (Werner), or from struggles made to relieve himself from hobbles (Weber). Benjamin has treated a six year old horse, phlethoric, taken with paresis while working: harnessed to a heavy load and obliged to make violent efforts, the horse suddenly fell, could not rise except with

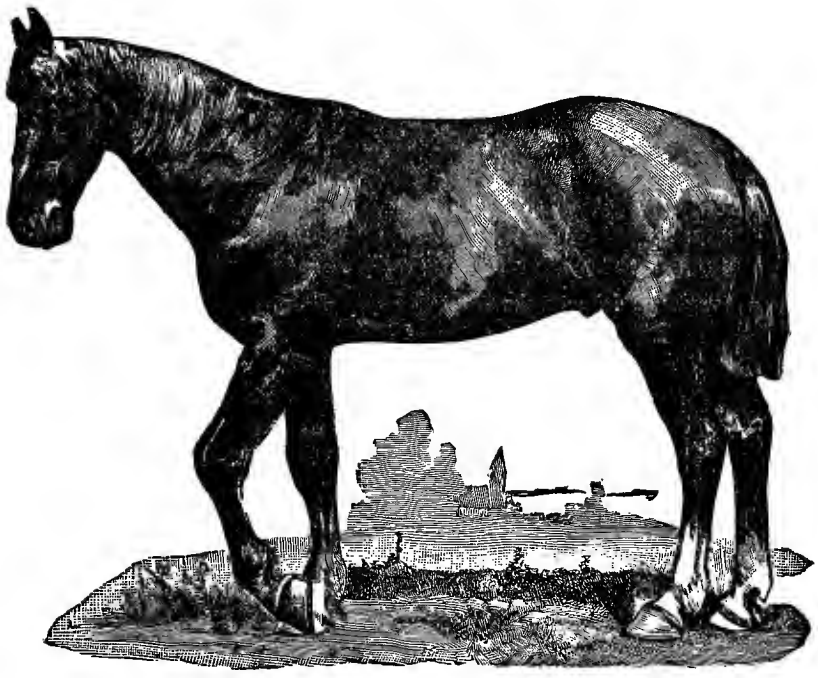


Fig. 93.—Complete paralysis of the radial. (Möller.)

difficulty, and presented symptoms of cerebral hyperemia, of inco-ordination of motions in the anterior extremities, and lastly in the right leg, and the functional troubles resulting from incomplete paralysis of the radial. Often this becomes manifest after a quick and long race. Bräuer has seen it after a long exposure to cold rains (rheumatismal paralysis). In one horse at our clinics, it occurred at night, probably from defective attitude or from a slip. Bowmann and Bräuer have related cases of double radial paralysis, occurring suddenly. Möller has seen that of the left nerve to be complicated in a few days with that of the right. In a case

observed by Fries, it became complicated after some time with paralysis of the opposite hind leg.

The *diagnosis* is not difficult. In a certain number of cases, paralysis is incomplete or partial: at rest, the standing is normal, sometimes there are twitchings of the olecranon muscles; in walking, the leg is carried forward with the joints semi-flexed, the foot drags on the ground. In very slight cases, the trouble is manifested only by slightly marked symptoms; but in quick gait, the legs flex to excess and the animal may fall. When paralysis is complete, the standing of the leg and the lameness are characteristic: at rest, the shoulder is depressed, the scapulo-humeral angle wide open; the olecranon muscles are relaxed, their mass less prominent; the elbow and knee joints are flexed; the extensors of the phalanges are paralyzed; the flexed fetlock is carried forward; the toe of the foot is sometimes on a level with that of the other leg, or again in front or back of the plumb line. The standing takes place on the toe or the anterior face of the foot and digital regions. Walking is very difficult; the leg is more dragged than carried forward; in the slightest standing, all joints are flexed. In a horse observed by Tondeur, the nerve having been bruised very low, where it leaves the groove of torsion of the humerus, the extensors of the forearm were not paralyzed, but the anterior extensor of the metacarpus and those of the phalanges functioned poorly and when walking was hurried the fetlock struck the ground. Changes in the sensibility are far from being proportional to the degree of the paralysis; even when this is complete, sensibility may remain well marked.

The *prognosis* varies with the cause of the paralysis and the intensity of the symptoms. In few cases, the affection is very serious. Goubaux records the observation of a subject which had to be destroyed the eighth day. We have seen a similar case: the paralysis was due to securing in crossed position; the animal was placed in slings, and kept there for a week; he had to be removed from them, when he dropped and died six days after.

These are exceptional cases. With this akinesia, whose symptoms are sometimes so alarming, rapid recovery is the rule. Twenty horses treated by Möller all made a recovery. Often improvement is manifested after one, two or three weeks; sometimes the symptoms remain in the same condition for several weeks and then disappear in a few days. Like Lustig and Möller, we have seen radial paralysis which did not disappear except after a long treatment. Möller mentions a case where recovery did not occur for nine months. To give up treatment too soon, because the symptoms persist at the same degree for several weeks, is a fault which one will not commit if the habitual march of the disease is known. On the horse shown in fig. 94 the paralytic troubles lasted for a month before

noticeable attenuation showed itself. A week later, he walked better. In two weeks he resumed work.

In all the cases where the paralysis is complete, it is always well to use slings, until the time when improvement is noticed, and even as long a time as the patient will stand them. The principal agents of the local treatment are revulsives, blistering agents and electricity. Goubaux resorted to the following treatment in one case: "Two needles, 15 centimeters long, were thrust half their length, one in the large extensor of the forearm, back of the scapulo humeral joint, the other in the short extensor of the forearm, near its insertion to the olecranon. Both needles were attached to

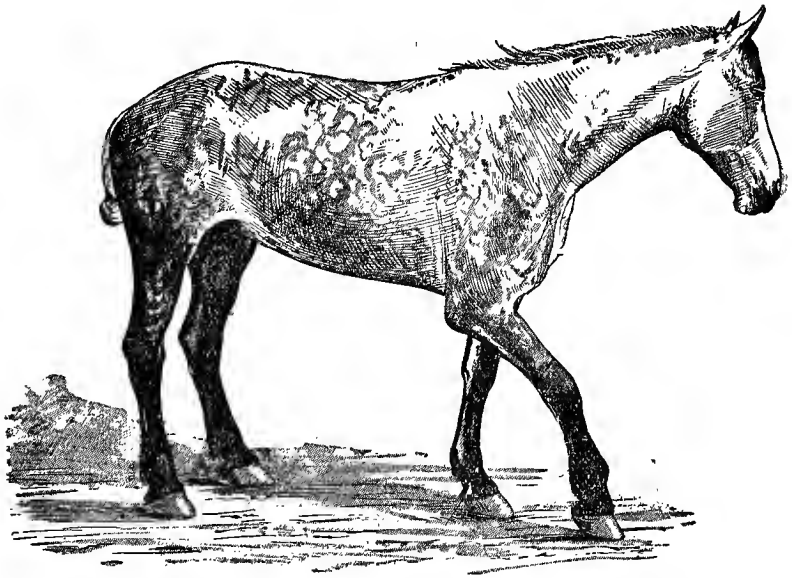


Fig. 94.—Paralysis of the radial on the road to recovery. (From photograph.)

the poles of an electric pile. Each time the current was closed, muscular, violent and jerky contractions would take place, moving the leg a little in all directions." Several seatings of ten minutes of this electrization were applied. The fifth day; the olecranon muscles, first flabby, had returned to their size and consistency, the animal was no longer lame and returned immediately to his work. Inductive instruments have considerably simplified the treatment by electricity and still it is little used in our animals (see *Paralysis in General*).

Blisters are used oftener. Goubaux has called attention to their good effects. The charge of Lebas or blisters are generally used. We prescribe a blistering application on the external face of the arm, and

administer 10 or 20 grammes of iodide of potassium. As soon as improvement appears, short walks, morning and evening, gradually increased, are beneficial. Subcutaneous injections of strychnine (0 gr. 025–0 gr. 05) or of veratine (0 grs. 10), made in the affected region, are recommended by Bormann and Möller. Those of salt water or spirits of turpentine may also be useful.

The treatment of incomplete paralysis is the same. The animal should be put in slings or left loose in a box-stall; locally, revulsives and blisters should be used.

IV.—Obturator Nerve.

This is generally mentioned only as consecutive accident of dystokial labors and fractures of the pelvis: it is produced by active pressures made upon the nerve on some points of its course, most commonly at the obturator foramen, either during the passage of the fœtus or by effused blood or again by a large callus. In all species, it may also be due to neoplasm of the neighborhood of the nerve; it has also been observed in white horses affected with melanosis of the pelvis.

At rest, the leg is carried more or less in abduction, the joints are flexed, the toe of the foot turned outwards. In walking, the extremity is moved with difficulty and with a motion of abduction. Little by little there is atrophy of the muscles where the nerve ramifies—adductors of the thigh, pectineus, short adductor of the leg. This atrophy with the conditions detected by rectal examination confirm the diagnosis.

Against paralysis due to tumors or a callus, there is nothing to do. For those of dystokial origin, "irritating frictions on the croup and thigh" have been recommended. Cold irrigations of the vagina and massage through its walls should be more efficacious. At times improvement occurs rapidly, even when no treatment is carried out; quite often the lameness does not disappear for months, sometimes it remains permanent.

V.—Femoral Nerve.

It is no doubt to "hemoglobinuria" or "congestion of the spinal cord" that most cases of femoral paralysis are due. Goubaux, Bouley, Reynal saw in it the consequence of rupture of the psoas, which is "of such delicate texture that it tears with the greatest facility, during life as after death" (Rigot). But paralysis of the triceps cruralis may appear at the onset of the disease, and at the autopsies of *all* the horses which had it, no lesions of the psoas could be found. In these cases it was either a myopathic paralysis, or a femoral neuritis, due, as myositis are, to rheumatismal or infectious process.

Among the post-hemoglobinuric symptoms, the most frequent is atrophy of the crural muscles, which is easily reproduced experimentally, as Goubaux did, in performing the division of the nerve "at the internal face of the thigh, on its superior portion, between the vastus internus and the anterior straight, where it furnishes its terminal branches."[1] This amyotrophy, generally evenly accused to the three parts of the triceps, is neuritic and not myopathic in origin.

At any rate hemoglobinuria is not the only affection able to produce the paralysis of the femoral nerve and its characteristic symptoms. It is useless to repeat here the causes already mentioned in the chapter on paralysis in general: abscesses, tumors, exostosis, intoxications. The first observation of the report of Goubaux had his foot caught between two stones of street pavement; he made a violent effort, tore his shoes, and became suddenly lame. Like the lameness resulting from section of the femoral nerve, this did not give away to firing applied on the thigh. At post-mortem, lesions of the great psoas and inflammation of the femoral nerve were found. Schmidt related a case with similar etiology. The patient of the second observation was affected with paralysis after a violent effort, and that of Observation VI after a fall. The horse treated by Trasbot had kicked in harness with both legs; the right foot, held back, was carried in forced abduction; "the psoas torn at the moment of the accident brought on a severe neuritis which demanded several months to get well." Gunther had already mentioned kicking backwards as a cause of femoral paralysis. Möller has seen six cases due to powerful muscular contractions.

Whatever may be the cause, the lameness of femoral paralysis is in all cases very expressive: the sudden flexion of the stifle and hock joint, every time the animal rests on the leg. The atrophy of the patellar muscles, gradually manifested, is another unmistakable sign.

The treatment of femoral paralysis which occurs as prodome or symptom of hemoglobinuria is connected with that of this last affection. To treat post-hemoglobinuric paralysis and those of other origin, all vesicating agents have been used. But cauterization is to be preferred. It is one of the affections where lines firing is specially indicated. Goubaux has tried electricity. A mare affected with this disease was cast; "two needles were thrust into the fleshy tissues, one on the anterior part of the croup pointing towards the lumbar region, the other at the lower extremity of the femur in the anterior femoral muscles. The needles were connected with a galvanic pile, and the parts included between them submitted to electric current for twenty minutes. Under this influence

[1] Goubaux, Rec. de Med. Vet., 1844, p. 492.

the leg executed numerous and violent contractions, which returned every time the current was turned on." The seatings were not sufficiently repeated to insure a noticeable result. While Goubaux doubted the possibility of recovery, all the subjects treated by Lebel with blisters and exercise recovered in a few months.

In many cases, exercise and time are sufficient for a recovery (Bouley). The patients should be left loose in a box; they will be turned out. The degenenation of the muscles will be prevented by daily massages, the application on the external surface of the thigh of repeated stimulating or blistering frictions or by firing. Subcutaneous injections of veratrine

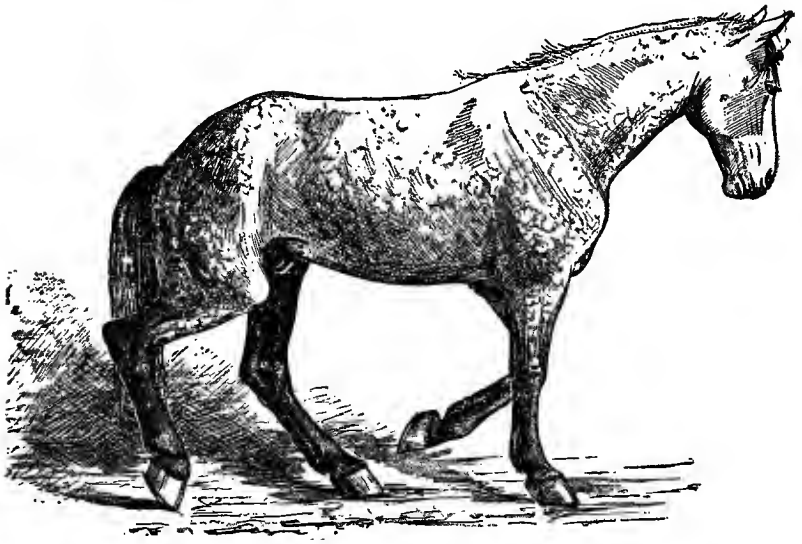


Fig. 95.—Paralysis of the femoral nerve. (From a photograph.)

(0 gra. 10) have a decided advantageous action. Saturated solution of salt is less efficacious and sometimes gives rise to rather extensive undermining of pus.

We prefer iodide of potassium (10 or 20 grammes a day) to nux vomica. As soon as walking is possible without being too tiresome, the patient should have light exercise. The atrophy of the patellar muscles is sometimes well marked, but nevertheless, for it also, recovery is the rule; after three to six months, the muscles have generally resumed their normal contractility and size. Incurable cases are almost all hemoglobinuric in their origin.

VI.—Great Sciatic.

Well protected at its origin by the thick layers of the gluteal muscles, the *great sciatic* is seldom affected, yet its paralysis has been observed in horses and in dogs. Ordinarily due to the forced extension of the hind leg, in a slip or by a fall on the hind quarters, it is characterized by the inertia of the totality of the muscles of the hind leg, except the triceps, which is innerved by the femoral; the paralyzed muscles become atrophied with time. Rodet has related the observation of a horse affected with a special lameness due to compression of the nerve. "The diseased leg was moved as if being thrown forward by a sudden jerky movement. In this action, so to speak automatic, the cannon and digital region were wavering; the cord of the bifemoro calcaneus being itself flabby and quivering." Backing was almost impossible; and often in walking, the anterior face of the fetlock rested on the ground. At the autopsy the great sciatic was found pressed upon by a melanotic tumor. Möller has mentioned three examples of this paralysis, observed in three large dogs.

It is not always present alone. In the horse it has been seen existing with paralysis of the brachial plexus of the same side (Trasbot) or of the opposite leg (Möller, Fries).

Under the title of *paralysis of the tibial nerve*, some German authors, Möller among them, describe the paralysis of the great sciatic, below the lower third of the femur. At rest, in standing, the hock flexes, the leg drops. During exercise, all the joints flex abnormally, the foot is carried upwards as in springhalt; trotting is impossible.

The treatment varies with the cause of the trouble. If the nerve is compressed by a tumor, extirpation of the growth alone is indicated. Against paralysis with unknown causes, blisterings and iodide of potassium should be tried first. Later, massage or faradization of the atrophied muscles and exercise are indicated.

VII.—External Sciatic Popliteal.

The *small femoro popliteal* or *external sciatic popliteal* rises from the sciatic on a level with the gemelli of the pelvis and runs from backwards forwards, from upwards downwards, towards the external face of the superior extremity of the tibia, where it terminates by two branches: the *musculo-cutaneous* and the *anterior tibial nerve*. The first ramifies in the lateral extensor of the phalanges and the skin. The second, the most important, goes to the anterior extensor of the phalanges and to the flexor metatarsi. It is exposed to injuries principally at its passage on the tibia.

Paralysis of the external sciatic popliteal gives rise to symptoms, well described by Goubaux. At rest, either the digital regions are flexed and the fetlock rests on the ground, or the foot stands firmly and nothing in the attitude of the leg indicates a nervous lesion (fig. 96). In walking, the execution of the movements is regular in the upper segments of the leg and the extent of the step is normal, but the extension of the phalanges being impossible, the toe drags on the ground and sometimes seems deviated inwards. At the moment of putting the foot on the ground, the standing takes place normally or the digital region is flexed on the cannon, and its anterior face as well as the fetlock rests on the

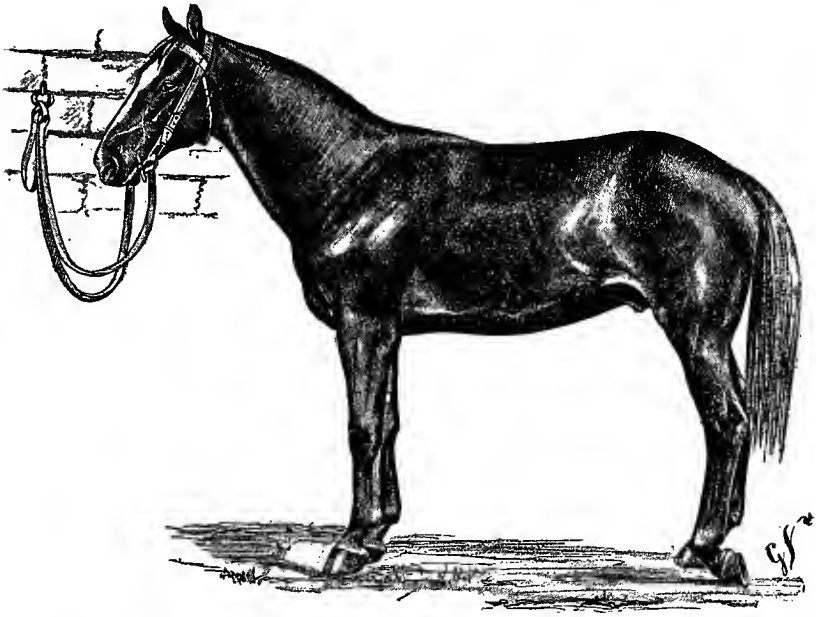


Fig. 96.—Paralysis of the external popliteal sciatic nerve. (From a photograph.)

ground; in this way the tibio-metatarsal angle is open to extreme, the leg and cannon are in the same straight line. Flexion of the digital regions is often frequent during backing. If the paralysis lasts, and the subject is kept exercised, the wall is much worn at the toe.

In a horse affected with this akinesia, after a violent contusion, Goubaux vainly tried blistering and cantherided pitch plasters on the course of the nerve. The case of Bouley in his first observation recovered by repeated applications of charge of Lebas. We had only one case of this nature to treat; he got well in three weeks by a single blister on the leg and exercise.

CHAPTER XI.

BONES.

I.

CONTUSIONS.

Contusions of bones are quite frequent in horses. Depending on various conditions (situation of the bone, thickness of the tissues which protect it), its gravity varies principally in proportion to the violence of the shock. At times the lesions are limited to the periosteum (undermining and subperiostic bloody extravasation); at others, the bony tissue is the seat of numerous hemorrhagic centers and of crushing inwards if the trauma has taken place on an epiphysis; the marrow itself may be the seat of a true bloody infiltration; and again the contusion upon one face of the bone may produce in some cases a chipping off or a fissure of the opposite face. The traumatic center not communicating with the exterior, the interested tissues are in favorable condition for cicatrization; oftener, exudates resorb regularly; after two or three weeks there remains nothing of those alterations.

For slight contusions which have been received on an exposed or badly protected bone, the animal should be left some time at rest. Douches or slight revulsive frictions (camphorated alcohol, charge of Lebas) favor the repair. With severe contusion, a severe lameness is manifested immediately, or in the following few days; an œdematous swelling appears, which may involve the bony structure; there may occur high febrile reaction. Often it is difficult to say if there is a simple contusion or a split of the bone. Experience for many years has taught that these traumas are frequently complicated with fractures; and it is not ordinarily in the first days that they occur, but only after several weeks, when rarefying osteitis has diminished the resistance of the bone; these fractures then have for determining cause either muscular contraction while at work, or some effort made by the animal, specially in getting up. Therefore, rest is again the first indication of treatment for violent contusions of the various bony levers. It is prudent, in serious cases, to place the animal in slings, to avoid his lying down and the efforts necessary to get up. The inflammatory phenomena may be treated with cold applications (douches,

white lotion compresses, alum water); but generally a blistering preparation is applied over the seat of the injury and extending some distance round it. This has several advantages; it hastens the steps of the bony inflammation, and by the pains it gives rise to, it insures the immobility of the leg; besides deciding the owner to grant his horse a useful rest in seeing the swelling and the effects produced by the blister. After ten or twelve days, if lameness remains, the blister is renewed. Return to work ought not to take place before five or six weeks after the accident, when, by the repairing osteitis, the bone has recuperated part of its solidity. Often, at a later epoch, a diffused exostosis develops at the point of the contusion; if it reaches large dimensions or produces lameness, alterative applications (red ointment, bichromate of potass ointment) or cauterization are indicated.

II.

WOUNDS.

In *pricks*, generally the point lacerates the periosteum, slides over the surface of the bone or breaks off; the spongy tissue may be penetrated quite deep. *Sharp instruments* injure bones in various thickness; in small animals, the section is sometimes complete, there is a true fracture. *Bruised wounds* (kicks, crushings) are the most frequent.

Made aseptic, bony wounds repair regularly; even when the periosteum has been largely involved, the bone becomes covered with granulations, there is not the slightest formation of necrosis. Minute disinfection is then essential. Sublimate (1 p. 1000), phenic acid or cresyl (4–5 p. 100) used in irrigations, baths or sprays, clean the traumatic center; wadded dressing, phenicated or iodoformed vaseline, then protect the tissues against external germs.

If the wound suppurates, sometimes the pus collects between the periosteum and the bone (sub-periostic abscess of Chassaignac), or the periosteum is destroyed upon a wide surface. Free incisions, drainage, washings, will prevent the retention of the pus, its putrefying in the bottom of wounds, and will protect against serious alterations. A superficial and limited necrosis does not constitute a great complication: the work of elimination goes ordinarily in a regular way and the wound, once free of the foreign body, is soon filled by granulations. (See *Necrosis.*) Suppurative traumatic osteo-myelitis gives rise to a large swelling of the region and to high febrile reaction. It may rapidly extend to the totality of the bone, and become complicated with septicemia or purulent infection. (See *Caries.*)

In the treatment of contused wounds of bones, as in that of contusions,

one must count with the rarefaction, the fragility of the injured organ. Long rest and sometimes the use of slings are indispensable to prevent consecutive fractures.

III.

FRACTURES.

Solutions of continuity of bones have extremely varying characters, which have permitted numerous divisions of their lesions. From the therapeutic point of view, it is specially important to recognize: 1st, *incomplete fractures*, in which only a part of the thickness of the bone is involved, and *complete fractures*, in which the dieresis is complete; 2d, *close fractures* without solutions of continuity of the soft tissues surrounding the traumatic center; and 3d, *open fractures*, with wound, exposing this center to infectious complications.

A.—Incomplete Fractures.

Among incomplete fractures are counted: *flexures*, or *bendings*, *partial fractures*, *fissures* and *interperiosteal fractures*. In *bendings*, specially frequent in young animals, there is either no solution of continuity of the bone, or it is injured in part of its continuity, "as happens in green wood, which on being bent breaks only on the convexity of the bending, and remains continued in the concavity, where stretching of the fibres has been less" (Bouley). *Partial fractures* or with *splinters* are characterized by the separation, from the body of the bone, of a piece more or less voluminous. To this are added the driving-in, the furrows or perforation made by projectiles. Most generally incomplete fractures are constituted by transversal, longitudinal or oblique *fissures*. The tibia, radius, metacarpus are, on account of their being subcutaneous, the most frequently injured. Whenever a violent traumatism has been applied upon a subcutaneous bony surface, a split must always be feared and treated as if it existed. The swelling of the region and the excessive lameness imply always serious lesions, exposing to complete fracture. As we have said, with rare exceptions, it is not in the first days that it takes place; the pain prevents the animal from resting on his leg or making any efforts, and the bone has not yet undergone the changes resulting from its inflammation. The fracture occurs most generally after several weeks or in the course of the second month following the accident. In a case related by Bouley, the tibia broke two months after the injury. In a horse treated by us for a contused wound of the internal face of the leg, returned to his work a month after the accident, the tibia broke five days later, while the animal was working. Another subject, a stallion, received

a kick on the upper third of the internal face of the forearm; he was, against our advice, taken home after twenty-two days. He had scarcely passed the door of the hospital, when, smelling a mare, he reared and fell on the lame leg; a crack was heard, the radius was broken at the place of the first injury. The horse recorded by Vitry had, six months before, received a shot on the right anterior cannon, the fracture taking place while walking; the lameness of the first injury had disappeared five months before.

Absolute rest constitutes the primordial indication of the treatment of incomplete fractures. The patient should be kept in the stable, tied up to prevent his lying down, or better, put in slings. It seems to us that Liard and Relier have exaggerated the inconvenience of the latter. Truly, some horses object to slings, but in the majority of cases, when they are well applied, that the animal is not raised from the ground, he can rest comfortably, specially if with them he has a good bed on the floor. If the other legs swell, cold lotions, massage, bandages should be applied on them. On the seat of the trauma, cold water and astringent lotions are recommended. Application of a large blister is preferable. In large animals, bandages are little used. After six weeks or two months, the animal is returned to work, light at first. With time, the exostosis which has developed subsides gradually; alteratives and needle firing will promote its resolution. In small animals, a diagnosticated split should be treated as a complete fracture.

B.—Complete Fractures.

Most commonly the result of external violence (traumatism, blows, falls, projectiles) or of muscular contraction, complete fractures, in all species, are peculiarly frequent on bones of the extremities. They are favored by local and general causes. Local inflammatory processes (osteitis, necrosis, caries), in reducing the resistance of bones, predispose to secondary fractures, which occur easily under the action of some occasional cause. The situation of some bones (radius, tibia, metacarpals, first phalanx) exposes them most particularly to traumatisms. Some general morbid conditions (osteoclasty, osteoporosis) modify the constitution of the bony tissue and reduce its resistance. Ordinarily, the lesions due to these morbid states are apparent in examining the fractured bone; there are cases where they escape the simple naked eye inspection. Advanced age is also accompanied with rarefaction of the bony tissue. In some families of animals, a special fragility of bones has been observed and with it numerous fractures on one subject, without discovering at the post-mortem any manifest alteration of the bony tissue (Stockfleth, Dieckerhoff). The relative frequency of fractures of the various bones of legs differs

with the animal species and the service to which they are used. According to some authors, in the horse, fractures of the superior bones are more frequent than those of phalanges. Verlinde, in 42 cases of fractures observed in a regiment of Belgian cavalry, during 12 years, found only 1 of the coronet, 1 of the ossa suffraginis, 1 of the navicular bone, while in 21 cases the femur was the seat of the lesions. Out of 159 cases of fractures of the extremities we have found: 5 cases of the scapulum, 13 of the humerus, 17 of the radius, 6 of the cubitus, 3 of the carpal bone, 30 of the pelvis, 6 of the femur, 32 of the tibia, 1 of the os calcis, 1 of the astragalus, 15 of the cannon, 24 of the first phalanx, 4 of the second, 2 of the third.

As soon as a fracture is suspected, the diseased leg must be handled and manipulated with care. To discover the "abnormal motility" or "the crepitation," extensive movements of the bony levers should be avoided, as they give rise to acute pains, sometimes to lacerations of the peri-bony tissues and of the skin, or to contractions followed by irreducible fragmentary displacements, or again to vascular or nervous injuries. The examination must be quick, complete, methodic and made with care. The deformity of the region, functional impotency, abnormal mobility, crepitation, acute pains, impose a diagnosis. Even in the absence of one or several of these symptoms, it can be made by the careful examination of the region. With fractures of the leg, it is often made by a glance. But with thick fleshy masses, as those of the arm or thigh, the diagnosis is more difficult, on account of their thickness, which interferes with the discovery of the essential symptoms. In the diagnosis of fractures of the pelvis, rectal exploration is rarely doubtful.

Let us recall the possible mistake that can be made of some fractures with contusion, tendinous rupture, a sprain, a paralysis. But, in general, the differential diagnosis is posed as follows: Is there a fracture or a dislocation? Methodic exploration of the wounded part, the location of the apophysis and the mobility, generally allow the solving of the problem. Abnormal mobility of fractures has a special character; it takes place in all directions and ordinarily is about as much accused whether the lower part of the leg is carried in flexion or extension, abduction or adduction. That of luxations is more limited; abnormal movements are produced more or less marked in a given direction, they are impossible in others; and again the leg left to itself is stiff, longer or shorter. When in fractures, reduction is not kept up, the deformity returns at once. In luxations, if it is more difficult, it is generally lasting.

There is a great, a very great, difference between the importance offered in the treatment of fractures in veterinary and human surgery. For our large animals, the preservation of life is not sufficient; with few excep-

tions a recovery perfect enough to permit the return of the freedom of motion and work is essential; and on the other side, treatment is often difficult, on account of their indocility and of the numerous difficulties one has to overcome to keep the fragments of bones in place. For these reasons, animals that have received severe injuries are generally destroyed. It is not because the repairing process is insufficient; with animals, the bony tissue has the same structure and behaves in repairs the same way as that of man does. The old belief that bones of animals did not unite is dead long ago. But the duration and the expense of the treatment, its imperfect result, the remaining lameness when it is a bone of an extremity, frequently are objections which command the destroying of the patient. Numerous cases exist where the interference of the veterinarian is limited to the making of a correct diagnosis. There are some cases, however, where treatment must be attempted, even in large species; it is when the regularity of locomotion is not indispensable to the usefulness of the animal (milking females, stallions, brood mares). Some conditions, favorable to the rapid and regular repair of fractures, must also be taken into consideration, such as the youth of the animal, its small weight, docility, the small displacement of the bony fragments, or the absence of wounds. Yet, let us repeat that it is a rule to destroy all subjects of little value.

Such is not the case with small animals. For dogs specially, treatment we always attempt. It is easy, success is almost sure and many owners do not hesitate on account of expense. Ankylosis, deformities, permanent lameness, even amputation must not stop us. The preservation of life is all that is wished for.

Once treatment is decided upon, if the patient is not near the house where he is to be kept, he must be carried there without aggravating the trouble. The fractured leg should not be left to itself; it ought to be secured at once, even by a temporary dressing. For dogs, oakum, some linen, wooden splints, bandages are sufficient. For large animals, walking should be avoided; extensive movements of the lower extremity of the leg promote useless pains and serious disorders at the fractured center; the bony ends may injure the skin, break it and transform a closed into an open fracture. The injured region should be enveloped with linen rags, a sheet, a thick pad of oakum; it should be immobilized with splints and bandages, and the patient placed in a wagon. The ambulance found in some large cities is very useful. In both the animal is kept in the standing position and secured so that he cannot lie down. Great care must be exercised when the animal is taken from those vehicles as well as when he is made to enter them, so as to avoid all struggles, mis-steps or falls by which the injury of the leg might suffer.

In some cases, if there is no displacement, the bone has kept its form, direction and normal length, the application of the contentive dressing may be made at once. But these cases are rare: ordinarily it is necessary to modify the position of the fragments. With certain fractures, where the displacement has taken place in the thickness of the bone, reduction is made with the animal standing; by pressures made upon one end, while the other is held firm, the normal relations are reëstablished. If displacement is more marked, if it necessitates difficult manipulations, it is prudent, after the application of a temporary bandage, to cast the animal. The muzzled dog should be kept on a horizontal table.

Reduction is simple if the ends are angular; it is more complicated if they are displaced in their length, overlap each other; then, there is shortening of the leg, which is kept up and supported by muscular contraction.

The manipulations of reduction include: 1, *Extension;* 2, *counter-extension;* 3, *coaptation.* Extension is applied on the lower fragment, counter-extension on the upper, while at the same time both ends are put in coaptation.

With small animals, most ordinarily the hands are sufficient to restore the muscles to their primitive length. Let us suppose a fracture of the fore-arm. The operator takes hold of the upper fragment with one hand, and of the lower with the other, and by opposite pullings replaces the bone in its normal length. If the dog is of large size, an assistant may be necessary to apply the counter-extension.

The reduction is more difficult in large animals, where muscular power is such that it resists the combined action of several aids. The subject cast on the side opposite to the fracture, has ropes secured on the upper segments of the leg and attached to the wall or to rings fixed on post; these are the mechanical agents of *counter-extension.* Other ropes are fixed round the coronet, the cannon or the lower extremity of the radius, always as near the seat of the fracture as possible, avoiding to squeeze the peri-fractured tissues; those are held by assistants, who apply the *extension* with slow, continued, regular pulling made in the direction of the axis of the leg. Manual tractions of several assistants are difficult to regulate; they are made by jerks, and often give only imperfect results. Tackle and pulleys work more regularly. *Coaptation* is the more delicate part of the operation. When thick layers of muscles cover the bone (thigh, arm) the ends of the bone are difficult to make out; if everything seems about in place, precision is difficult, and yet on this part of the operation depends the complete success or the defective recovery of the fracture. For members, the mode of displacement of the lower fragment may be indicated by the position of the foot, the direction of the toe; these must

be taken into consideration. Fragments badly brought together unite, but the callus is voluminous, irregular, the leg is shorter, deviated; a permanent lameness is the result. It is specially with heavy and strongly muscular animals that it is difficult to obtain perfect juxtaposition of the fractured ends. Splinters, interposed muscular fragments, a great obliquity of the opposed bony surfaces are as many causes which render the work of coaptation difficult. For the olecranon, the external angle of the hip, the point of the ischium, muscular contraction keeps the fragments apart and renders their coaptation impossible.

In some cases, muscles, spasmodically contracted, resist so much more that they are more pulled upon; traction awakes contraction. To relieve these "muscular rebellions," anesthesia must be resorted to. With dogs, an injection of morphine given first is advantageous: it throws the organism into a state of torpor faciliating the effect of anesthesic vapors; it reduces to almost nothing the period of excitement; by it, violent movements likely to complicate fracture have been avoided, while they generally occur if anesthetic inhalations are used alone. With large animals chloroformization or mixed anesthesia should be resorted to, carefully holding the ends of the bone close together during the period of excitement. Muscular relaxation obtained, the fracture is reduced, the ends coaptated and the immovable bandage applied. It is advantageous to continue the administration of the anesthetic until the apparatus is well settled and can resist the efforts of the animals and of the muscular contraction.

Must we in all cases of fractures apply immediately the manipulations of reduction? If there exists a large bloody effusion, a big inflammatory swelling, is it not better to wait until after the diminution of the swelling? In man, Dupuytren and Velpeau have said that reduction must be immediate, in whatever condition the fractured center is. If, as much as possible, one must act before the period of inflammatory phenomena, one must avoid acting harshly on an inflamed fracture, compress it, or twist it, as phlegmonous or gangrenous accidents might follow. The bony fragments are surrounded by the exudate, the clots of blood; the hand cannot detect them well, they are not felt, and coaptation is only imperfect. Malgaigne has shown the enormous resistance offered by inflamed muscles, in the reduction of fractures. A weight of one kilogramme, attached to the paw of a rabbit whose thigh was fractured, produced, the very day of the accident, only one centimeter of elongation; two days later a weight of three kilogrammes gave only one of 5 millimeters. In another rabbit, suffering with fracture of the tibia, the overlapping, which was of two centimeters, was overcome the first day with the simple weight of 125 grammes; two days later, one of 5 kilogrammes elongated the leg only one centimeter and half. The twelfth day, 9 kilo-

grammes gave only an elongation of 5 millimeters; 25 kilogrammes did not give any more, and the tibia broke under the weight. One can judge by those data of the effort demanded, if in place of a rabbit, it was applied on a horse or on a steeer!

Reduction, then, should be applied in the shortest time possible, before the inflammation has invaded the peri-fractured tissues; however, if inflammatory phenomena exist, it is better to wait for their attenuation. Such are the indications derived from the above considerations.

The bony fragments in good position, they must be kept in it. The internal skeleton being wanting, a temporary external one must be supplied. Let us consider the means of contention:

In animals, specially the large ones, perfect immobilization of the center of the fracture is not an easy matter. The difficulties are so much greater that the patients are more rebel and heavier. The horse cannot stand on three legs for a long while; continually he tries to rest on the injured extremity. And if the dog keeps quite willingly the decubital position, if with him the dressing is easy to apply, it is rare if he does not try to get rid of it.

There are two kinds of dressings: the *movable* or *immovable*. The first may be changed frequently; no hardening substances unite the various parts composing it (oakum, splints, rollers). The immovable must remain in place until recovery is completed; an agglutinative substance makes all the various consecutive pieces adhere together. These dressings are most used in our surgery; more solid, firmer than the others, they offer more resistance to the teeth of dogs, and constitute an envelope of excessive hardness, likely to take the place of the fractured bony lever.

The substances used to make these bandages are: oakum, wadding, rollers and a great number of hardening substances or preparations.

In general, the region is first covered with a layer of oakum, filling up hollows and forming a pad to protect the skin from the pressure of splints. These are most ordinarily little thin boards of wood, that can be had anywhere; those of metallic wire netting have the advantages of being light and easily adapted to the region; molds of zinc, gutta-percha, felt, pasteboard are also used. This last is very useful in canine surgery; it is cut in strips, having the form, the length and the width of the leg. In large animals, a greater resistance being necessary, more solid pieces of wood or iron are used. Splints must be made not only to cover the fractured bone, but also those that are contiguous to it; they must immobilize completely the articulations to which the fractured bone coöperated to form above or below; in dogs it is proper to envelop the entire extremity down to the paw. The number of splints varies: for small animals two are generally enough; three or even four may be necessary for large species.

The ordinary roller is that used most generally; bands cut from old sheets and sewed together answer the same purpose.

We have but one word to say in relation to the movable dressings. In them, the leg being enveloped with oakum or wadding, and the splints well in place, the *rolled bandage* is applied all round from below upwards. The *Scultet* differs from this, in having, instead of a single roller, a series of separate bands, which are secured by pin or stitches of suture. This permits the exposure of any one part of the dressing alone, without disturbance of the whole.

When a solid, permanent dressing is intended, it is necessary to unite its various constituents together and with the skin, in using a substance, first fluid, but becoming hard, solid by dessication, and able to give to the leg a real fixity, to constitute, as Malgaigne said, an "external skeleton" to replace the internal one, broken in its continuity—it is necessary to apply an *immovable* one.

Black pitch, which is found everywhere and hardens rapidly, is much used in veterinary practice, even for large animals. It is often mixed with turpentine, which renders it more fluid. The first coat applied on the skin must be semi-liquid, so as to avoid the formation of scabs its application may give rise to. The pitch, having a tendency to soften under the influence of heat, must be sprayed several times a day with cold water. Gombault has recommended the mixture of equal parts of black pitch and resine. Delwart advocates a preparation made of black pitch 1000, Burgundy pitch 1000, turpentine of Venise 500. The following mixtures are also recommended: two parts of resine and one of yellow wax; five parts of gutta-percha and one and one-half of resine.

The use of *gum arabic* goes back to the hippocratic epoch. It is used dissolved in warm water, or thick syrupous solution. It requires six or eight hours to harden. It is softened with tepid water when the bandage is to be taken off. In place of gum arabic, the mixture of Abulcasis is used, or that of glue made with flour, white of eggs and alum. Let us again mention the agglutinative preparations of Larrey (white of eggs beaten in water, camphorated spirits and white lotion), that of Seutin (starch boiled in water), of Velpeau (100 parts of dextrine, 60 of camphorated spirits, 50 of hot water), of Lafontaine (warm mixture of burnt alum and alcohol). Laugier cut little bands of paper 4 or 5 centimeters long, covered them with shoe-maker's wax on both faces and rolled them round the fractured leg. This mode, undoubtedly simple, has the objection of requiring twelve hours to harden. The mixture of starch and plaster (Lafargue) hardens quick.

Introduced in the therapeutics of fractures by the Arabian school, *plaster* was not utilized in Europe until the beginning of this century;

in veterinary practice it was recommended by Bernard, in 1839. First it was used like the moulders do: the leg placed in a grooved splint, thick plaster was moulded all round it. The dressing thus obtained was very heavy. To Mathysen and Van de Loo is due the credit of the fortunate innovation of plastered rollers. To prepare them, bands of tarlatan are taken, and on both faces plaster is dusted or rubbed in; these bands are kept in metallic boxes. When they are to be used, they are first sprinkled with water, or slightly moistened with wet sponges, and then rolled round the region to immobilize, in layers more or less thick according to the mobility of the fractured ends. To-day, bands prepared *ad hoc* are used. Generally simple bands of tarlatan, dipped in paste of plaster, are employed. The plaster paste must not be too thick, nor too thin; it is prepared with equal quantities of water and plaster, kept perfectly dry, and that has not been exposed to the air. Bands impregnated with this paste are rolled round the broken leg: solidification takes place in ten minutes; the dressing is so hard that it resists the most powerful efforts. Circular plastering has some objections: it either presses the fracture too much or not enough, and does not permit examination of the injured region. Actually, in human surgery, plastered splints and gutters are used. The splints made of tarlatan, folded in ten, twelve or fifteen thickness, are covered with paste of plaster, then spread over the leg or the fractured region, without wrinkling, and held in place by assistants; the leg is then enrolled with a band which makes the splints adapt themselves well on the irregularities of the leg. When solidification is sufficient, this band is removed, the various parts of the apparatus are then secured by ligatures placed at various parts of its height. In this manner, a very firm contentive mould is obtained, which can be applied, closed and removed at will. Plastered gutters are cut out on the healthy leg. This mode of application is the same as that of splints.

The bandage of Beelz, excellent for large animals, is made of plastered bands, between which are placed coating of lint. In Germany "tripoli" is much used; it is a mixture of plaster, carbonate of lime, of magnesia, coal and sand; this mixture hardens rapidly and forms a mass more solid than plaster. (Möller).

Advantageous as it may be, plaster cannot be of general use. It is not as convenient for fractures of the superior parts of the legs; its want of fixity in these cases has been a just reproach to it in those instances.

For fractures of extremities, Simon recommends gutta-percha applied as follows: the reduction made, the fractured region is envolped with a pad of wadded peat, then upon that are disposed two gutters of gutta-percha, soldered together afterwards with a cultellar iron heated red. So as to avoid excoriation of the skin, a pad of wadding should always be placed be-

tween the skin and the apparatus.[1] According to the indications, fenestra can be made in this apparatus without diminishing its resistance. Solidification is quick. To remove the dressing, the envelope is split with a knife or with the cautery.

With *silicate of potasse*, very firm bandages can be made, but their objection is that they take several hours to harden. Bands of linen (Fregis) or of paper (Brun) are impregnated with it. Fregis uses it principally for dogs.

From this rapid consideration of the various bandages we may draw the following conclusions: In cases of simple fracture, without inflammation or marked swelling, apply immediately an immovable dressing, giving preference to those made of plaster, silicate or dextrine. To the superior regions of legs, resort to pitch or resinous mixtures, which adhere to the skin and do not get loose. If there is marked swelling, acute sensibility or considerable œdema, the best is to apply, first the Scullet or a wadded bandage, consolidated with splints. After a few days, when the inflammatory symptoms are attenuated, apply an immovable dressing. If the fractured region was plastered immediately, the bandage would have to be changed after a few days, as soon as the leg would be loose in the apparatus.

Adjuvants to bandages. In large animals, bandages, notwithstanding their resisting force, might give away under the great weight they have to support, when the animal rests upon the fractured leg. Iron supports are added to them, the first specimens of which are due to Chabert and Bourgelat. Some of those are not without value and do not deserve to be put aside as they are in our days. In his *Essay Upon Apparatus and Bandages* (1770), Bourgelat describes iron splints which could yet to-day fulfil useful indications. For fractures of the coronet he had a shoe, to the heels of which two metallic rods were attached. These were connected at the base of the fetlock by a concave plate, padded, which supported the fetlock. For the fractures of the cannon or of the forearm, a rod is started from the toe of the shoe, and run as far as the scapulo humeral articulation, which it supports by a widening forming a broad plate. Many other apparatus copied on these have since been invented.

In cases of fractures in large animals, it is important to prevent the patient from lying down, efforts to get up being likely to disturb the

[1] For many years we have used gutta-percha, specially for fractures in dogs in general and principally those of the extremities. After protecting the skin with a layer of wadding, the entire extremity or only part of it, as the case required, was enveloped with a band of gutta, softened by dipping it in warm water; when the splints were well adapted and glued together, it was cooled off with sprinkling cold water over it. This form of splints, besides being firm and easily removed, is very light and can therefore be used with the smallest animals.—A. LIAUTARD.

apparatus or the juxtaposition of the ends of the bones. To this effect slings are used. To avoid the fatigue of the superior muscles of the leg, which hangs inert and loaded with its bandage, it may be advantageous to have the leg itself placed in suspension, in slings, by having it raised off the floor in a support of some kind, attached to the ceiling of the stall or the ropes of the apparatus of suspension. In digging the floor of the stall on a level with the fractured leg or raising the sound ones, all possibility of resting on the leg is prevented and the work of repair not disturbed.

Through the *Bulletin de la Société Centrale de Médecine Vétérinaire* (1883), Relier has given the description of an apparatus, contentive and suspensory, which he uses after the application of a dressing of circular rolls and agglutinative mixture for fractures, complete and incomplete, luxations, serious articular sprains and diseases of the feet, where carrying of weight is impossible. Relier claims for his apparatus great superiority over the ordinary apparatus of suspension. In connection with this let us recall the fact that the crutch of Relier's apparatus had already been recommended by Lafontaine, who recommended the use of one made of wood, to give support to the fractured leg, instead of placing it in a special sling as Relier does.

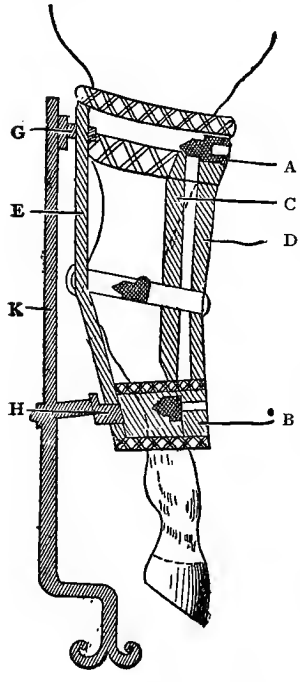


Fig. 97.—Apparatus of Rélier.

Up to recent years, the complete immobilization of the center of the fracture has been considered as the absolute rule. All defective, protruding callus, all the varieties of pseudo-arthrosis were attributed to an insufficient contention. And much surprise was expressed when, in 1866, Championnière came and condemned all old methods, advocating immediate massage and precocious mobilization, which gives a more rapid and sure recovery.

Immobilization is advantageous; it permits the regular formation of callus and averts the danger of "refractures" which may occur during the influence of shocks or of movements of torsion of the leg, when the new bony trabeculæ have as yet only a slight solidity. But it is not necessary. Who has not seen dogs recover without the least treatment? Do not

fractures of the ribs unite notwithstanding the continual movements of dilatation and depression of the chest? Let us also say that it is not without objections. Compressed under a heavy dressing, the leg "breathes badly," atrophies, stiffens, ankyloses. To be perfectly curative, the treatment of fractures ought to reach two ends: immobilize the bony ends which are the passive organs of movements, and mobilize the muscles and tendons which are its active organs. If there are cases where these two conditions cannot exist together, there are some where they do. To this point of view, fractures can be divided into two groups: 1, those where the abnormal mobility of the bony fragments is very limited (some fractures of the phalanges in horses, of one of the metatarpal or metatarsal of dogs); 2, those where the disposition of the ends of the fractured bone is such that they can readily be displaced and easily overlap each other (fractures of the cannon, forearm or chank).

For the lesions of the first kind, nature has provided for the contention; immovable dressings are not necessary and vascular and nervous compressions are to be avoided. The complete freedom of the leg, a slight massage of the fractured region, some passive movements of the surrounding treatment—that is the rational therapeutics. Scarcely is it worth, to please the owner, to place on the diseased surface a wadded dressing with the splints and a few turns of loose rollers. After some ten days, the apparatus will be removed to permit massage and mobilization. In case of phalangeal fracture in horse, often some apply only a blister upon the coronet.

But it would be imprudent to treat in the same manner fractures of other bones, where the ends are oblique and greatly displaced. Here the first and constant indication is to hold solidly the divided parts in their normal position, so that the callus shall not have excessive dimensions. It must also be acknowledged that the bandage is "analgesical; numerous dogs groan continually before the reduction of their fracture, and stop as soon as the bandage is on."

Cagny has published several results obtained in dogs by the method of Championnière. The author does nothing, absolutely nothing; no manipulation of reduction, no bandages. The wounded animal is placed in a quiet place. He can go about, but everything that might cause him to make some sudden movement is avoided. As food he gets meat, bone and milk, with a little laxative if there is constipation. Recovery occurs rapidly without marked deformity, without lasting lameness. The Observation IV of Cagny shows that the method is not free from reproach. In a grey hound that had a fracture of the tibia, and was treated by expectation, there was left a very noticeable exostosis, irregularity in motion and a deformity of the leg. We may admit that in this case the owner was to

blame, as "he allowed the dog to run up a stoop of several steps, upon which the dog fell repeatedly"; but we believe that facts of defective consolidation and voluminous callus will always be frequent in fractures of the legs treated by this "leaving alone" method. Even in dogs, and notwithstanding the successes of Ribaud, the process is indicated only in fractures of our first group. It is not applicable to large animals; their great weight and the tendency they have to rest on the diseased leg demand a solid bandage. For fractures of the extremities, except for those interesting phalanges, contention must always be energetic and continued for four or five weeks in young animals, six weeks to two months in adults and old ones.

In dogs, whenever there is displacement, we apply a dressing, and it is only between two weeks or a month after, that, according to the age of the subjects and the strength of reunion in the fragments, we begin passive motion or allow motion and massage of the region. This latter is advantageous; it "develops muscle," stimulates the circulation, spreads out the peri-fractured exudates and favors their absorbtion by lymphatics. One of the principal conditions of success, is to know to wait for the time where massage is to be used. Complete immobility is in any case very difficult to obtain in our animals; its inconvenience is much less dangerous than in man.

The bandage must be carefully watched. An excessive pressure may bring on irreparable complications. They are manifested by dulness of the patient, loss of appetite, reactive fever. If the dressing leaves the inferior part of the leg exposed, the toes are swollen, perhaps oozing and covered with blisters. If the apparatus is removed, superficial or deep sloughs may be found. In such cases, the injured parts should be left exposed for several hours, and washed with phenicated water; little by little the swelling will subside, the circulation is re-established, the heat returns; then another bandage moderately tight is applied. When a first dressing has been applied on a tumefied leg, it may happen that after a few days it is loose, the leg moves in it. Then it must be changed or a certain quantity of mixed plaster be introduced between the old one and the skin.

Notwithstanding the care taken in applying the dressing, if after a certain length of time it happens that it is out of good position, it must be removed or consolidated. A removal will permit the surgeon to observe the condition of the peri-fractured structure and to be assured that the ends of the bone have assumed their normal position.

There is no absolute rule as to the length of time the dressing must remain in place; this varies according to the species of animal, the age

of the subject and the mobility of the fracture. Generally it takes a month for small animals, or two for those of large species.

Some care is required in removing it. When made of pitch, it is soaked in water at 45° or 50°; the pitch softens, and the bands can be unrolled. This process succeeds also for dextrine or starch splint: the circular turns of bands can also be cut with scissors, the splints are easily taken off and the pad adhering to the skin is pulled off. Plaster moulds resist more, and sometimes have to be broken with a hammer; plastered rollers are cut away with pruning-shears.

The bandage removed, it can be seen if the fracture is consolidated. Evidently one must go very carefully, specially if it is feared that the callus is not strong. The animal is afterwards left to himself. The lameness may not have disappeared entirely, standing on the foot may yet be difficult, but by degrees the motions become more free and the circulation more supple. There are, however, cases where the lameness continues; the callus being large, interferes with an articulation, a nerve or a tendon. Fine, deep or penetrant points cauterization is indicated to stimulate the partial resorption of the periosteum, or, when the fracture exists on the lower part of the extremity, neurotomy, which destroys the morbid sensibility of the parts.

We shall be concise in relation to *articular fractures* and *epiphysar detachments.*

Open articular fractures are extremely serious: they generally become complicated with purulent arthritis. When the fracture is *closed*, it may consolidate regularly, without complication; but the repair is generally slow, often imperfect, and may be followed with complications: arthritis and ankylosis are common; an exuberant callus may prevent all motions in a joint. There are cases when there is no work of consolidation. In the treatment of these fractures, immobilization must not be kept too long; massage should be made early to avoid stiffness and ankylosis of joints.

Epiphysar detachments occur in young animals. The reduction and contention are generally difficult, on account of the small size of the epiphysar fragment. The treatment is the same as for fractures in general.

Complications of fractures are numerous. *Contusions and bloody exudation* are the obligatory epiphenomena of fractures; but when they are extensive they constitute a special gravity: tissues extensively contused, crushed under an intact skin, may later on mortify and transform a closed into an open fracture; a large bloody effusion has a tendency to suppurate; on that account the slightest wounds must be carefully disinfected and the region protected by a wadded dressing moderately compressive. Wound of an important artery gives rise sometimes to a diffused

hematoma, which on feeling gives a pulsating sensation. If collateral circulation is not formed, gangrene by ischemia is possible. Against this hematoma, wadded pressure of the fractured region or ligature at both ends after free incision of the tissues, are recommended. *Fever* is never entirely absent, but has little importance as long as the animal remains gay and eating. If the temperature marks or goes beyond 40°, the trauma must be carefully watched. Purgatives and diuretics are sufficient to overcome a slight fever. *Thrombosis, embolies, emphysema, superficial wounds, diffuse acute inflammation* of the region are again possible complications of fractures. *Gangrene* has always a serious prognosis. It may follow a severe contusion, arterial lesions, severe inflammation, excessive compression. Superficial sloughs should be treated by antiseptics, fenestrated bandages or frequently changed dressing. In dogs, gangrene of all the lower part of the leg demands amputation.

Under the influence of local or general causes, many of which are yet badly understood, the callus may take long to form; the started ossification stops, it seems as if the patient was unable to make bone. To those animals, strong food and exercise should be given, the diseased regions massaged and douched; if phosphate of lime and phosphorus are not "infallible bone making agents," they possess as much properties as tonics do, and are not without being advantageous. Springer, by his remarks, has revealed the osteogenous properties of cereals; these should be utilized. At times, callus is not formed between the ends of the bone; these are simply united by fibrous tissue, or again the two surfaces become covered with cartilage, surrounded with pseudo-synovial, and a true arthrodia is formed. It was said that this was due to the want of coaptation and insufficient immobilization; but the condition of the patient and some diathesis play a great part in their development. In man, the researches of Cooper, Dupuytren and Tillaux have shown that there is almost always the interposition, between the ends of the bone, of muscular, tendinous or aponeurotic fragment. When the pseudo-arthrosis is finally constituted, in our patients, no further treatment is necessary, but in small animals, interference may be called for. First it was tried to irritate the two bony fragments: 1, by rubbing them against each other; 2, by cauterizing the inter-fragmentary fibrous tissue or scarifying it subcutaneously; 3, by passing setons through the false articulation; 4, by injecting irritating substances in the fractured center. Dammann has cured two pseudo-arthrosis of the metacarpals, in the horse, by two injections, three days apart, of 6 grammes of a mixture of equal parts of lactic acid and distilled water. These methods are to-day abandoned.

Some successes have been obtained by inter-fragmentary galvano-punc-

ture. A steel needle (negative pole) is introduced in the fibrous callus: a chamois skin applied on the surrounding cutaneous surface is used as positive reophore.

Another mode consists in starting therapeutic congestion on a level with the pseudo-arthrosis. This is obtained by applying a rubber roller, not too tight, above the fracture, after this has been consolidated by an immovable apparatus. The authors who have employed this method of artificial congestion claim to have obtained good results; but it is only successful when the inter-fragmentary tissue is fibrous and therefore susceptible to ossification. When the ends are separated by a muscular band, its resection is the indication. In man, the bony stumps are made fresh, and then united by metallic sutures; silver thread is the best to use. Aseptic metallic plates, screwed on the bony fragments, fulfil the same indication; but the screws which are used to secure them to the pieces of bone may produce rarefying-osteitis, and consecutive accidents are to be feared. Quenu prefers to them a bony rod, taken from calf, 10 or 12 centimeters long, and engaged into the medullary canal of that fractured bone. "How does this bone act?" Not only as support, but no doubt in irritating the bone and promoting the formation of osteoblasts.

If the fracture has been badly reduced, if the bony ends are not kept in good coaptation, a large callus or a defective direction of the leg may remain. A first indication to recommend is to again break the callus, by a sudden action of the hands or with the osteoclast. Antiseptic osteotomy ought to be tried. But these serious complications cannot be treated in small animals.

In the same way, if the callus compresses a large nerve and brings on paralysis, the patient is generally destroyed, although it has been proved in human surgery, that nerves can be isolated from this bony enveloping neoplasm.

Open Fractures.

Open, complicated or *exposed fractures*, are those in which the injured part communicates with the outside through a solution of continuity of the soft tissues. This solution of continuity may result from the traumatic action, cause of the fracture; it is sometimes made from inwards outwards, by a displaced splinter pushed through the skin; in some cases it is consecutive to the elimination of sloughs. With these fractures, many variations of ligamentous, bony, muscular and cutaneous lesions are found; in general, they are accompained with extensive lacerations.

In dogs, crushings by being run over by carriages or tramways make very serious lesions; through the perforated, lacerated skin, the torn muscles or tendons, as well as the open articulations, are exposed; from

the fracture, with its numerous splinters, several fistulous tracts start, and the wound is generally soiled with hair, dirt and other foreign substances.

The infection of a fracture recognizes for cause the introduction, in the morbid center of pathogenous elements deposited by the injuring agent or the foreign bodies that it carries, the instruments of exploration, the fingers of the surgeon, the material of the dressings. To purify the wound, is the first indication; if aseptization is perfect, the fracture recovers rapidly; the callus, first embryonic, becomes rapidly bony without passing through the cartilaginous stage, as in close fractures.

The dimensions of the external wound vary very much: sometimes very small, it must not be explored, irritated or soiled. An abundant and lasting flow of blood makes one fear the communication with the center of the fracture. If in doubt, one will act as if the most serious lesions existed, the surrounding regions will be shaved, disinfected, and the wound freely irrigated with liquor of Van Swieten or strong phenic solution and covered with iodoformed collodion, gauze or wadding; the whole followed by immobilization of the leg, as we will show further on.

If one of the fragments protrudes through the solution of continuity, it must be cut off with the saw or sharp shears, specially if the periosteum is removed, as its necrosis is necessary fatal. Thorough disinfection as above, and then dressing.

When there is a large wound and with splinters (fractures by wheels of carriages, by firearms) the strictest antisepsy is again in order and directs the further process of the traumatism. The shallows of the wound should be freely enlarged and examined. The extent of the wounds should be immediately ascertained and decision taken as to whether it is better to treat the wound or amputate the leg (dog). If the former is decided upon, the loose splinter, uncovered of periosteum, should be removed; condemned to die, they would promote suppuration in the wound, be the cause of lasting fistulas, and later on impose "necrotomy." The splinters, covered with periosteum, protected by an antiseptic dressing, may contribute to the repair. If the ends of the bone, which are to unite, are pointed and sharp, it is better to enlarge their surface of coaptation by cutting a small part of them with the saw or bone nippers.

These operations ended, the wound is to be cleaned with extreme minutiæ with strong antiseptic solution. Some bony sutures (silver wire) and cutaneous as well (silk) may be applied. After free dusting with iodoform and boric acid, the wound is filled with iodoformed gauze, or sutured and drained.

The bandage of Scullet is the best for complicated fractures: the wounded region is covered with wadded pads, immobilized with splints and linen rollers. An immovable dressing with dextrine, plaster or gutta-

percha is applied, in which, on a level with the trauma, a window is cut out, to disinfect it. Movable dressings must be removed quite often, guided by the abundance of the secretions of the wound, the temperature of the patient, the severity of the pains. That which must be avoided at all price, are diffused suppurations, osteomyelitis, purulent infection.

Prothetical apparatus not being applicable in our surgery, as long as a little sensibility and heat of the leg remains, and circulation and innervation seem preserved, amputation must not be performed, but saving of the parts should always be attempted.

Long antiseptic baths, well carried out dressings will permit, without danger to the patient, the elimination of dead tissues and "nature is always more saving than the knife." It is thus that we proceed with complicated fractures of dog. We leave dead tissues eliminate, and are satisfied in avoiding complications by scrupulous antisepsy. We have obtained excellent results. Lately, when the amputation at the hock seemed necessary, we were able to preserve for a dog the greater portion of its metatarsal and phalangeal regions.

If, however, the bone is much altered, crushed in numerous splinters, if arteries and nerves are destroyed, if the wound suppurates and if the general condition is serious, it may be necessary, to preserve life, to resort to the ablation of the leg.

The technic of the operation is regulated: After the application of rubber garrote, circular incision of the skin on healthy structure, dissection of a part of it to cover the stump, amputated a few centimeters above the cutaneous incision. The muscles are cut with the bistouri, the bone with the saw, the large vessels are ligated with silk or catgut, the skin drawn over the stump and sewed. Antiseptic dressing. After a few days, remove the stitches. Generally in three weeks or a month, the cicatrization is completed.

Fractures are frequent in *birds*, not only in the domestic gallinaceous, but also in the other orders. Of all the bones, the humerus, tibia, femur, are those on which fractures are most commonly seen; they are rare in the cubitus, radius, ribs or shoulder.

On account of the presence of air in the hollowed tubes of the long bones, traumatic emphysema is often met with, and in cases of open fracture, allowing the escape of air, the bird has difficulty in flying, even if its wings are free from injury (Richard Owen, Gürlt, Larcher).

In the thirteenth century, Demetrius published a treatise on the treatment of fractures of hawks. Dieterichs wrote one on the treatment of these in gallinaceous. Often, when the lesion is left to itself, it repairs irregularly and leaves a large callus; sometimes, however, when the bird condemns the wounded part to immobility, the consolidation is regular.

Fractures of Extremities.

I.—Scapula.

Lying obliquely on the lateral face of the thorax and protected by a muscular layer, the scapula is relatively little exposed to fractures. Falls and contusions are the most frequent causes. They occur on the acromion, one of the superior angles or the body of the bone and most commonly the neck.

Fracture of the acromion is manifested by a circumscribed tumefaction, often very painful, situated a little below the middle part of the scapula. By the application of a pitch bandage or a blister, it is rare if consolidation takes place: often the broken portion of the bone necroses and acts as foreign body; an abscess forms after a few days; punctured, it gives escape to a watery pus of bad nature; the fistula may cicatrize and reappear later on. The observations of Hartenstein have shown the inefficacy of caustic injections (Villate solution, tincture of iodine, sulfate of zinc), of continued irrigation and of cauterization. Enlarge the wound and extract the mortified bony piece are the indications. Antiseptic injections insure recovery in a short time.

In *fracture of one of the superior angles* of the bone, there takes place, as in most cases of fracture of the olecranon and of the angle of the hip, a marked displacement, due to the contraction of the muscles attached on those angles. Reduction is impossible, but by blisterings and rest, recovery is easily obtained. The fragment becomes fixed in the place it has taken, the inflammatory phenomena subside, the lameness disappears.

More serious are the fractures of the *body* and of the *neck*. Most ordinarily the bone is divided transversely to its long axis, sometimes parallel to it, and then the glenoid cavity is generally involved. The prognosis is so much more serious that the fracture is more inferior. Pains are less acute and the separation of the edges of the fracture less accused when the injury involves the body of the bone. Great pain, excessive lameness, lancinating sufferings are bad omens. When the fracture is comminuted or intra-articular, arthritis and purulent infection may be looked for; yet, regular consolidation may occur, as shown by the cases of Delaporte and Plouvier. Recovery, however, demands a long time: often the callus is very large, there is atrophy of the muscles and the lameness persists. Godine, Zundel, Schachinger, have obtained in horses recovery of the fracture of the neck. We have also treated with success a large draught horse of six years. Fracture above the neck unites easily in cattle.

"Reduction of fracture of the scapula should be made with the animal standing; the little displacement of the fragments makes it easy; to do it, it suffices to keep the leg in extension and press in, with the hand close, the protruding portion of the bone" (Delwart). Contention is not indispensable (Delaporte and Plouvier). Furlanetto only applied a blister upon the shoulder of an eight-months' bull; the lameness did not disappear; the animal was used for breeding.

To keep the fragments in firm position, various apparatus have been recommended. The iron splint of Bourgelat is composed of a metallic band thrown over the withers and covers both shoulders. That which rests upon the injured one terminates by a plate-enlargement, upon which is secured by screws a piece of felt, which presses upon the center of the fractured region. Godine has obtained good results with the following: After application on the shoulder of a mixture of pitch and Venice turpentine, wide bands are laid from the withers, across the shoulder, chest, axilla, twisting round the elbow, crossing the scapula again from downwards upwards to the withers, going over the opposite leg and enveloping it in the same way, to return to the fractured shoulder, upon which was laid an emplastic mixture at each passage of the band. This was continued until the dressing had acquired a certain resistance.

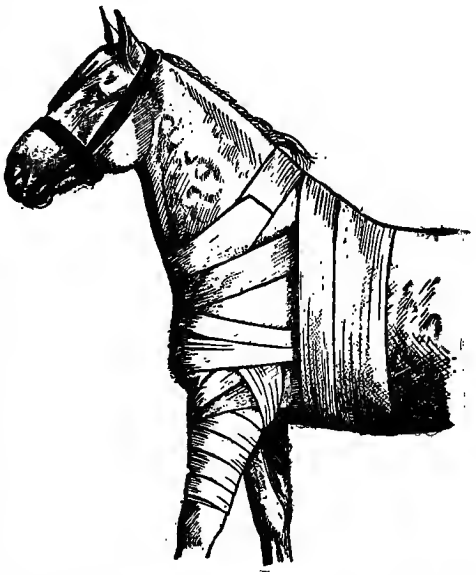


Fig. 98.—Bandage for fractures of the scapula and for those of the humerus. (Delwart.

Delwart, in his method, used bands of linen, three or four fingers wide, which he dipped in a mixture of pitch and Venice turpentine. A certain number of rolls are placed round the arm and brought back to the superior part of the shoulder, crossing each other at the point of fracture. Others, starting from the withers, run down the shoulder, surround the shoulder-joint and go to be fixed, some on the chest, others on the forearm. From the knee upwards, this region is also enveloped by rollers, others from downwards upwards: to give more solidity to the dressing, a new

series of bands is applied which starts from the posterior part of the shoulder, and goes to be fixed upon the opposite shoulder after surrounding the chest. A last layer of rollers surrounds the thorax, and reinforces the posterior part of the dressing. Although the author advises to have the animal in liberty, to allow him to lie down and get up, it is better to place him in slings: a greater immobility of the part is obtained, the callus is smaller.

Lafosse has advised the use of a bandage made of a light collar and a light saddle, with its sides extended downwards to the back of the elbow. The two are united together by straps supporting padding and splints covered with stitching mixtures which are laid over the surface of the shoulders.

Once the contention insured, as much as possible, the subject should be placed in slings; if not that, a good soft bed will be given for him to lie on. As long as the work of repair lasts, the bandage shall be watched and if necessary consolidated with new bands of rollers and pitch. After six weeks, the whole thing will be softened with warm water; for a week or two, the region should be massaged, hot lotions should be applied, and if the callus is very large cauterization should be resorted to.

In small animals, when the inertia of the leg, the sensibility of the shoulder, the crepitation, indicate fracture of the scapula, the animal is cast on the opposite side and the leg is held in extension. The manipulations for reduction are easy; in general there is but little displacement. Coaptation obtained, an immovable dressing is applied, analogous to that used in horses. Bands dipped in pitch and passed first under the arm come across the shoulder; others surround the superior part of the forearm; then longer ones are placed which from the withers are fixed downwards on the external surface of the forearm and point of the sternum. A few surround the chest as belt; others, fixed on the base of the neck, consolidate the whole apparatus. It is good to wrap up the shoulder, thorax and base of the neck with a kind of apron, which prevents the litter from sticking to the bandage. The patient is left in liberty. After twenty or thirty days the apparatus is taken off; the callus is sufficiently firm. Massage and passive motions will prevent ankylosis and amyotrophy. Lameness sometimes remains for months.

In young dogs, epiphysar detachments of the scapula or humerus are observed. Their treatment is that of fractures, but articular lesions are likely to complicate the injury and impede the function of the leg.

Open fractures demand the destroying of large animals. In the smaller species, a penetrated immovable bandage or a wadded dressing should be applied and the wound treated antiseptically. (See *Open Fractures*).

II.—Humerus.

Fractures of the humerus are ordinarily the results of traumatic actions or falls, and sometimes of muscular contractions. Rossignol, Ernes, Goubaux, have seen fractures take place while walking without excessive effort.[1] They are in general twice as frequent on the epiphysis as on the body of the bone. Stockfleth has collected nineteen cases of fractures of the extremities and only seven of the body. Whether epiphysar or diaphysar, recovery is possible, specially in small animals. Stockfleth and Möller have treated successfully dogs affected with bilateral condyloid fractures. But prognosis is serious for animals of large species; though in few exceptional cases, where the displacement and mobility of the extremities were not excessive, consolidation was obtained (Henon, Cholet, Lafosse, Lafontaine, Furlanetto). Lafosse has watched a case which, left to himself, was able to resume work in a stage-coach after three months. A similar result occurred in a six weeks colt. In the *Veterinarian* (1855) is found the observation of a four-year-old horse which recovered of a fracture of the humerus without the application of bandage; the animal was very quiet, the fracture simple and with good adaption of the extremities; the animal was placed in slings; after three months he walked easily.

When the ends of the bone remain close to each other, consolidation may take place without bandage; but generally it is an oblique fracture, comminuted; the fragments overlap, contention is difficult.

Black pitch has often been utilized for the making of bandages in fractures of the humerus. They can be alternate with mixture of pitch and oakum (Baritaud), or the method of Delwart (See *Fracture of the Scapula*). With this bandage, Furlanetto has cured a steer two years old and several young ruminants. He always operated with the animal standing. The patients were allowed to lie down and get up during the whole treatment.

Lafontaine used a mixture of alcohol (1 liter) and crystallized alum (500 grammes), which he boiled down to the consistency of syrup; he also prepared a mixture of equal parts of rosin and black pitch. Having a nine-year-old horse to treat, suffering with fracture of the upper part of the humerus, he surrounded the leg with oakum impregnated with the solution of alum; placed two splints, covered with a coat of the mixture of rosin and pitch, crossed in X over the fracture, and two others, also covered with the same mixture, alongside the leg; one, the external, extended to the withers; the other, internal, as far as the axilla. Circular bands,

[1] Burchsted has recorded one case in a fifteen months' bull injured during the act of copulation.—American Vet. Review, vol. 22, p. 571.

glued together with the mixture, were applied from the foot upwards to the shoulder, and passing then over the withers, from the front backwards, and from backward forwards, were at last secured at the point of fracture with the adhesive mixture. The animal was left to himself. The twenty-fourth day the animal rested on his leg, the apparatus was taken off the forty-sixth day. After two months and a half he resumed his work as a cavalry horse. Recovery was perfect.

Beaufils has described a method of treating fractures of the humerus and of the femur, which has given him good results in goats and which he believes is applicable to horses. With a long band of linen, he keeps the injured leg against the parts contiguous to it. Let us suppose it is a small animal which has a fracture of the left humerus. The animal secured in the standing position, the operator takes hold, with the right hand, of the forearm below the elbow, then with the left hand, raising the arm of the animal by its middle, he carries it in an upward motion, so as to bring it alongside the corresponding side of the chest, where he holds it. The band is rolled a certain number of times round the chest and the arm is kept in the new position. To have a solid contention, however, it is necessary to involve in the bandaging the elbow, the superior part of the forearm and the shoulder; other circular rolls serve to support the lower parts of the leg. Bands with pitch covering the whole, consolidate the apparatus. A large sized animal must be placed in slings.

Tried at the Lyons clinic, it proved successful only in a goat. Dogs would not keep it.

As rightly remarked by Lafosse, fractures of the humerus in small animals recover well. The muscles of the arm and shoulder are sufficient to hold the fragments in position. With simple fracture, without great displacement, a pitch plaster is advisable. When the more movable ends are likely to overlap each other, the bandage of Delwart is recommended for fractures of the superior part of the bone; for those of the lower part the method described by Peuch and Toussaint in their *Traité de Chirurgie* is indicated. It is as follows: The material necessary consists of: Fine oakum arranged in small pads, dressing linen or wide bandages, a mixture of pitch and turpentine, a solution of dextrine or of silicate of soda, and splints, made of pasteboard and cut in the pattern of the leg. One of these will be placed on the inner side of the leg and extend from the axilla to the foot; the other, placed on the outside, must reach the shoulder joint. All being ready, the dog, muzzled, laid on a table on the opposite side to the diseased one, is held quiet. The coaptation obtained, to remove all irregularities of surface and give the leg the form of a perfect cylinder, the operator envelops the fractured region and the other parts of the leg with oakum dipped in the sticking mixture of pitch or of dextrine.

The splints, also covered with the same, are placed over the oakum, and methodically, from below upwards, the roller is applied from the lower end of the leg, carefully avoiding excessive pressure. A thick coat of oakum generally protects against gangrenous accidents.

The application of this roller demands the making of a great many "*renversés*," twisting the band on half turn, specially at the elbow, so as to insure a close application of the roller, which will be secured together by the sticking mixture, to the oakum, to the splints; or again may be sewed up with needles and thread.

During the first days, the patient must be watched closely. High fever, anorexia, groans, indicate too much pressure. The cutting of a few turns of the band permits to examine the condition of the toes, which sometimes are greatly tumefied or already covered with blisters, or almost mortified. In this semi-sloughing region, the circulation may be restored by suppression of the bandage. But gangrenous accidents are not much to be feared when the apparatus has been properly applied. They occur only in cases where the pressure is too great at the seat of the fracture and when the bandage does not cover the whole length of the leg.

This method, so successful with small animals, differs little from that of Lafontaine, and it is not surprising if that operator had obtained good results with it in horses and ruminants.

For large species, as soon as the standing is firm, continued, and the pulsations of the collateral artery of the cannon are felt, Möller recommends to leave the animal at liberty. The bandage is kept in place for six weeks at least.

With dogs, it is ordinarily removed after three weeks or a month. Generally the bony fragments are then firmly united, and it is rare if another bandage has to be applied. During convalescence, douches and massage are indicated. Locomotion is painful for some time, but by degrees regains its freedom.

III.—Radius.

Well separated from the trunk and but little protected in the greatest part of its internal face, the radius is frequently subjected to fractures, ordinarily due to traumatisms, falls and sometimes muscular contraction. Cases are commonly recorded. Lafosse, Portal, Tassy, Bonnefond, Rossignol, S. Bouley, Degive, Bringard have reported interesting instances.[1]

[1] Walrath has recorded the case of a performing elephant which after an exercise of rope-walking was found lame on the inner foreleg with a fracture of the inner forearm. He was destroyed and it was found that the ulna was fractured transversely across its lower third and the radius also in several pieces.—Am. Vet. Review, vol. 10, p. 319.

Notwithstanding their serious nature, numerous cases have been followed by recovery. Unfortunately, the uncertainty of the result has decided against the treatment, and animals are often destroyed.

As for all other fractures of the extremities, the opinion of the practitioners, in the use of slings, is divided. Some, like Tassy and Portal, reject them entirely; they say it is dangerous, tiresome to the patients, causing gangrenous accidents and fever, which induce the animals to hang in them. Yet most veterinarians continue to employ them. It is only in exceptional cases, with very irritable subjects, as the stallion "Physician," treated by S. Bouley, that it is better to leave them free.

Therefore, in general, the fracture must be reduced, dressing of contention applied and the patient slung. If there is overlapping of the fragments, he must be cast and placed under anesthesia, being careful, in reducing the fracture, to give the foot a good direction.

With a simple wadded dressing, well applied, Salchow has obtained a complete success. Portal has recommended pitch. The coaptation made, the fractured region was coated in its whole extent with liquefied pitch, upon which a thick coat of oakum was laid; four wooden splints held with turns of rollers finished the dressing. With this bandage, Portal has cured a mule affected with an open comminuted fracture. After two months, the subject was slightly lame; a points firing was applied over the seat of the fracture, the lameness disappeared and the patient resumed work.

In a horse having a complete fracture of the radius, without displacement, Tassy enveloped the leg (from the axilla to the middle of the cannon) with oakum dipped into a mixture of eggs and burnt alum. Four wooden splints, wrapped up in oakum and covered with Venice turpentine, were placed on the four faces of the leg, the external one extending from the shoulder to the coronet, and the whole was held in place by turns of rollers sewed together. The patient, possessing an extraordinary instinct of preservation, would lie down carefully, without putting the slightest weight on its fractured leg. After thirty-six days, the apparatus was taken off; the callus was very large and made the animal very lame. Firing was necessary. The lameness disappeared entirely.

Rossignol, treating a simple fracture of the radius in a four years colt, first surrounded the leg with oakum dipped in a mixture of starch, white of eggs and powdered alum. Four wooden splints, going not beyond the extremities of the forearm, were fixed by turns of a roller, impregnated with the same sticking mixture. A wound of the external face of the knee was dressed with tincture of aloes, through a window made in the corresponding part of the bandage. This dressing was taken off the fortieth day; the callus was very large and the forearm atrophied, but, after a

few months, the muscles regained their ordinary size and the lameness disappeared.

In a horse having an oblique fracture, Delwart applied a dressing that he described as follows: The fracture being reduced, the animal standing, wide bands of linen covered with resinous mixture were applied from inwards outwards, upon the fractured spot, and drawn, crossing each other, over the external face of the forearm and of the shoulder; similar bands were arranged from the middle of the cannon to the level of the fracture; a pad of oakum laid on the internal face of the olecranon was fixed by two long bands crossing each other over the shoulder and secured on the sides of the withers and of the neck; and then a wooden splint, extending from the foot to the superior part of the shoulder, was fixed by circular turns of a roller. The animal was placed in slings. Four weeks after the bandage was taken off; the horse was very lame. Four months later, his gait was normal.

For fractures of the radius, Lafontaine has advocated the same apparatus as the one he used for those of the humerus.

Already in 1847, Bonnefond recommended the plastered bandage. On a fifteen-year-old mule suffering with an oblique fracture of the radius, he rolled round the broken region long pads dipped in diluted plaster, upon which he applied splints, also plastered, and kept in place by bands of the same nature. After two months the apparatus was removed, the patient left loose in a spacious place; he stood well on his foot, there was no deviation in the leg. A horse treated the same way returned to work after three months, notwithstanding a slight deviation of the leg inwards. Möller recommended a plastered bandage from the knee to the olecranon.[1]

Although serious, the prognosis of radial fracture is not necessarily fatal. Lafore and Lafosse have obtained the recovery of an oblique fracture of the radius, involving the radio-carpal joint.

If the fracture is open, fenestrated bandages permit the attendance and care of the wound, which at the same time they immobilize. Bringard has cured a mare suffering with an open fracture of the radius, with arthritis of the knee. The bandage being applied with mixture of Piau, the articular lesions were treated with ordinary means (sublimate 2 p. 1000, nitrate of silver, ægyptiacum.)

In small animals, complications must not prevent the practitioner from

[1] In a case of compound fracture of the radius in a two-year-old filly, McLean performed the amputation and the animal recovered.—Amer. Vet. Review, Vol. 12, p. 371.

In the case of Adair, the mare, fifteen years old, was pregnant by a very valuable fast stallion. She had sustained a compound fracture of the left forearm, the bone protruding through the side. The leg was amputated and the mare recovered, and gave birth some two months after to a colt.—Am. Vet. Rev., Vol. 11, p. 547.

attempting the treatment. By immovable dressings and antiseptic washings, Degive has obtained the recovery of an open fracture of the fore-arm, complicated with large contused wound, and complete periosteal denudation of the broken fragments. In such cases, tepid antiseptic baths are very advantageous. (See *Open Fractures.*)

In young dogs, one meets sometimes with fractures of the inferior epiphysis of the radius, badly united. It is generally possible to break up again, with the hand, the defective callus. Or, again, the fractured centre might be exposed, the callus broken, and the fragments replaced in their proper straight line, followed by a new dressing.

IV.—Cubitus.

In horses, the cubitus is united to the radius in the greatest part of its extent, except at its superior extremity, above the elbow joint which forms the olecranon. Fractures of this bone frequently occur on a level with the radio-cubital arch, but they may also take place between the beak of the olecranon and the superior extremity of the radius; they are transversal or longitudinal.

When longitudinal or existing at the radio-cubital arch, the pieces of bone are kept in contact by the fibrous apparatus which surrounds them. In the observations of Mercurin, Gombault, Watrin and Viard, no elevation of the olecranon is mentioned. In the case of Mercurin, where it was drawn slightly inwards, no contentive bandage was applied; the animal was only placed in slings, and recovered completely. Pernaud only used emollient lotions; consolidation took place, but after several months the horse was still quite lame. Gombault applied a somewhat complicated bandage. In his Observation II., he used seven splints secured by bands and a mixture of black pitch and rosin; recovery was perfect. A seven-year-old horse (Obs. III.) and a four months colt (Obs. IV.) recovered without lameness remaining. Watrin and Viard resorted to a bandage with splints, stucked with dextrine and securing the elbow, fore-arm and knee. Delwart is sure that fracture of the olecranon recovers radically in the majority of cases and advises the following treatment: when, by extension of the leg, one has succeeded in reducing the fracture by carrying the foot backwards, a quite thick pad of oakum is applied on the inside of the elbow, to support the olecranon on the inside and push it outwards; this pad, which has been impregnated with resinous mixture, is held in place with immovable bandage described for fractures of the scapula and humerus. During treatment, the animal may remain free, lie down and get up at will, without any inconvenience.[1]

[1] Delwart—Traité de med. Vet., Vol. 1. p. 530.

If the bony fragments have remained in contact, it is useless to have recourse to a bandage as complicated as that of Gombault. With Reynal, Peuch and Toussaint, we prefer an emplastic bandage.

Lafosse says: When the fracture is complete, the apophysis is carried upwards by the contraction of the olecranon muscles. The coaptation is difficult; too often a fibrous callus forms between the fragments. In such cases, the flexion of the forearm makes the inter-fragmentary space "gab;" on the contrary, extension closes it more or less. There is then advantage to carry the leg backwards, to extend the leg, as advised by Delwart. To insure the coaptation, one must take pattern on the apparatus of Malgaigne for fractures of the olecranon in man; a padded truss, extending from the middle of the arm to that of the forearm, should be placed in front of the elbow joint and held in position by dextrined or tarred rollers. A slip made on each border of this truss, a little below the joint, would permit to secure the turns of rollers, oblique upwards and backwards, and which would press downwards the olecranon fragment. Immobilization cannot be kept up too long; ankylosis is as much to be feared as the fibrous callus.

In a cow, Gombault has treated successfully a fracture of the lower end of the radius. The bandage in such cases can be made of plaster or pitch; it is sufficient for recovery.

In swine, dogs and cats, the cubitus is a long bone, distinct from the radius; it may be fractured alone. The contention is insured by the radius. Recovery follows always, even without dressing. Nevertheless it is better to apply a plastered, dextrined or starched bandage.

V.—Carpus.

The serious nature of fractures of the carpus is due to the unavoidable complication of arthritis and ankylosis. Fortunately, they are very rare. Trélut (1868) related the case of a horse, which, falling heavily after rearing, crushed the bones of the knee. He was killed; 36 fragments of bone were counted, the biggest being the size of a pea.

Caussé has observed the fracture of the trapezium, on a horse which had made violent efforts to relieve himself from a hobble which held him attached to the ground. After a few days of unsatisfactory treatment, he was destroyed. Fracture of this bone seems to be produced sometimes, principally in race-horses, by muscular contraction. It gives rise to severe lameness, which diminishes gradually; but a difform callus is formed which produces a lameness that sometimes lasts for months. (See *Splints*).

The articulation of the knee playing a primordial part in locomotion of the anterior legs, recovery of its fractures of the bones which compose it —except the sus-carpal—is naturally very incomplete; the treatment to advise is only for animals that can be used for breeding purposes. A plastered or pitched bandage should be applied. If lameness remains, median neurotomy is indicated. The treatment of an open fracture demands before all the antisepsy of the fractured center.[1]

VI.—Coxal.

Formed by the union of three bones—ilium, pubis and ischuim—the coxal forms in uniting with that of the opposite side, almost the totality of the pelvis. Its fractures, ordinarily produced by falls backwards or on the sides in large animals, by being run over in dogs, may involve the ilium, ischuim, pubis, cotyloid cavity or several of those parts together. The two coxals may also be separated from each other at the pubic symphisis or fractured simultaneously.

For the generality of cases, the diagnosis is easy, on account of the deformation of the croup, the detection of the bony crepitation, a bloody extravasation or a callus. Often rectal or vaginal exploration is necessary. If lameness is rarely missing at first, it varies very much in its severity. When the fracture has taken place forward of the cotyloid cavity, besides the lameness there is shortening of the step forward, but the resting of the foot is firm; when, on the contrary, it exists back of the articulation, there is specially pain and stiffness in resting; when it occupies the cotyloid cavity itself, pain is very great at rest and the lameness much accused; in fractures of the ischuim, the leg may be carried in abduction, even at rest. (Möller).

The *ilium* is frequently injured on its antero-external angle, the angle of the haunch; sometimes a single tuberosity is broken off and remains attached to the bone; then the deformity is slight and slightly marked; crepitation is scarcely perceptible. More often, the angle of the haunch, completely loose, is more or less drawn downwards by the contraction of the ilio-patellar and fascia lata muscles. There is no crepitation, but the deformity of the region is characteristic: in the "*hipped*" horse, there is an irregularity in the width of the hips, disappearance of the angle on the corresponding side to the fracture. A hard, resisting mass, formed by the loose piece of bone, is felt in the flank. Lameness is more or less

[1] A fracture of the trapezium recovered without lameness or stiffness was recorded by Howard (Amer. Vet. Rev., Vol. 15, p. 601).

An unsuccessful case of comminuted fracture of the os magnum and trapezium was recorded by Harrison (Amer. Vet. Rev., Vol. 1, p. 492.)

accused. Coaptation and contention being impossible, permanent deformity of the hip is unavoidable. But all the troubles caused by this fracture disappear always without any treatment, when it remains close and not exposed to infection. Recovery is assisted by the application of a pitch plaster or of a blistering preparation. Ordinarily after three weeks or a month, the subject returns to his work. Delamotte has related a case of fracture with numerous splints and congestive abscesses. The animal died of septicemia.[1]

More serious are the fractures of the neck of the ilium. Death may occur rapidly from internal lesions produced by the fragments of the bone. In the filly of Tombs, which died in three hours, there was laceration of the vagina, of the uterus and rupture of the vena cava in front of the pelvis. Excessive lameness, of long duration, gradual lowering of the hip on the corresponding side, crepitation when the leg rests on the ground, such are the principal symptoms of fracture of the neck. Rectal examination establishes the diagnosis.

Treatment is attempted only with costly animals. The animal should be left loose in a box or be placed in slings. Blistering applications have evidently only a very mediocre efficacy. Long continued rest must be depended upon. The callus, often large, deforms the anterior diameter of the pelvis and renders females unfit for reproduction.

The fractures of the *cotyloid cavity* have for causes falls or slips; the articular surface of the coxal is crushed by the head of the femur. Almost always the cotyloid cavity is divided in three parts; the lines of fractures do not seem to correspond to those of the union of the three bones in the cavity (Barrier). There is severe lameness, acute pains, sometimes crepitation, even when the leg is not at rest. There is little deformation at the hip, outside of a muscular depression. Rectal exploration enlightens the diagnosis; but this is sometimes very difficult, specially when the fracture is recent. At the autopsy of a horse, killed on account of incurable lameness of a hind leg, Prietsch found a fracture of the cotyloid cavity, which had not been diagnosed during life. Such lesion is fatally complicated with arthritis.[2]

Fractures of the *floor of the pelvis* take place in the same condition as

[1] In the case of Dr. Kemp, the animal had sustained a fracture of the external angle of the ilium, but, as demonstrated at the post-mortem, a laceration of the ilio muscular artery had occurred, giving rise to fatal hemorrhage.—Am. Vet. Rev., vol. 6, page 544.

[2] In the case of Tritschler the horse had reared and fell backwards on the near side. While treated, the leg had become shortened, the coxo femoral joint very prominent. At the autopsy it was found that the fracture was at the middle of the coxal bone, the acetabulum being crushed in several pieces and the femur displaced upwards.—Amer. Vet. Review, vol. 12, p. 513.

the preceding ; they generally occupy the obturator foramen. Rey, Serres, Jouannin and many others have published cases of it. Nocard, in the *Archives of Alfort* (1876), has written an article on them. There is no deformation of the croup, but ordinarily the lameness offers special characters ; the leg is moved in abduction ; the animal walks as if suffering from severe sprains of the loins ; he always has difficulty to get up (Rey). Later, there appear amyotrophies of the thigh and hip ; the callus fills the obturator foramen, compresses and atrophies the posterior crural nerve, which animates the inferior part of the ischio-tibial muscles and also the obturator nerve, distributed to the muscles of the internal face of the thigh ; the adductors and flexors of the leg are paralyzed, the leg is moved in describing a circumference outwards by the exaggerated action of the abductors ; the thigh alone flexes, the remainder of the leg follows the movement, but is moved without flexion.

Rectal examination rarely leaves the diagnosis uncertain. In some cases, death is produced by the rupture of the obturator vessels ; in others, the atrophic manifestations which we have mentioned prevent recovery. Sometimes the callus diminishes in great proportion the diameter of the pelvis, and mares which have been treated cannot be used for reproduction. However, recovery is possible, from the fact that the fragments are held in place by powerful ligaments and muscular attachments and have no tendency to displacement. The therapeutics consists only in immobilization in the slings. In the case of Levrat, the right ischium was fractured near the cotyloid cavity ; after two months the mare was able to walk ; a month later she was working on the racing track free from lameness ; the following year she was used as a brood mare and delivered several colts.

In case of fracture of the *ischiatic tuberosity*, the loosened bony piece is pulled downwards by the ischio-tibial muscles ; the result is a peculiar deformity of the croup : flattening at the height of the ischial tuberosity and an abnormal projection on a level with the articulation. In some cases this fracture gives rise to a displacement, a "luxation" forward of the posterior portion of the long vastus. (See *Muscular Luxations.*)

VII.—Femur.

Frequent in all species, fractures of the femur involve the diaphysis or the epiphysis. Many cases are related of compound and comminuted fractures of the diaphysis. Greeve has made the autopsy of a cow where the femur was crushed in eighty-five pieces.

Fractures of the *neck* are quite common. Fromage de Feugré, Rigot, Leblanc, Gurlt, Williams, Percivall, Gamgee, Nocard, Pourtanel, have

published many observations. Some cases have also been recorded of fractures of the *femoral head, of the inferior articular apophysis* (Stockfleth, Möller), *trochanter, subtrochanterian tuberosity.*[1]

Except in this last instance, whatever is the seat of the fracture, there is no economy in trying to treat them in large animals. Reduction is difficult, on account of the great muscular force to overcome, and contention is nearly impossible. With few exceptions, consolidation cannot take place without a large callus, a shortening of the leg or a permanent lameness. Rey has, however, seen a horse in which a fracture of the femur had united spontaneously. Bassini has obtained the recovery of a fracture of the neck (?) in a bull; the thigh was enveloped in a supporting bandage and the animal left loose. Four months after the accident, the animal stood nearly plumb, and was able to work with its leg in normal position.[2]

In small animals, fractures of the femur unite readily. On more than 20 dogs, Lafosse has always obtained union, with either pitched bandages or by only expectation. We have used a bandage of pitch on the hip, the external face of the thigh and of the shank, and have obtained a recovery in a month. Delwart recommends, when the coaptation is once made, to pass under the groin bands which cross each other over the thigh and secured on the summit of the croup, while others are fixed on the external face of the thigh and leg.

Beaufils has recommended the same bandage as for fractures of the humerus. The animal kept standing, the operator with one hand pushes the stifle of the fractured leg toward the flank, while with the other he raises the thigh, in order to bring the broken bone parallel to the great axis of the body; turns of rollers, starting from the injured thigh, are passed all round the body, until it is well immobilized; then the other parts of the leg are flexed and supported with more rollers; finally, to prevent the apparatus from slipping backwards toward the tail, two bands covered with pitch are applied over the whole length of the croup.

Felizet has invented a singular mode of contention. The animal, laid on a board covered with straw or hay, is secured with turns of rollers, passing several times round the body and the semi-flexed legs, and afterwards secured to the board by means of points nailed in the board. A dog with fracture of the neck of the femur, treated in this manner, was let loose twelve days after "with his femur entirely and regularly consolidated," but a goat and two cows died in a few days. This method

[1] A fracture of the internal lip of the trochlea of the femur is recorded by T. Walrath in which the bony hard edges of the fractured portion, as well as the base of the trochlea, has been removed by absorption.—Amer. Vet. Review, vol. 10, p. 78.

[2] Furlanetto, Prog. Vet., 1890, p. 362.

is evidently good only for animals which are not very irritable; simple immovable bandages are preferable.

VIII.—Patella.

Lafosse, Renault, Lenck, Goubaux, Andrieu have related interesting cases of fractures of the patella. They are due to traumatisms or muscular contraction. Lafosse thought that transversal fractures only were possible, but the observations of Lenck and Goubaux have proved the existence of longitudinal injuries. In both varieties, the accident may be simple or complicated; it is always accompanied with inflammation of the femoro-patellar, synovial and sometimes with femoro-tibial arthritis. It is on this account that Lafosse, d'Arboral and Goubaux erroneously thought that those fractures were incurable.

In the case of Lenck, the separation of the fractured segments was considerable. On the pieces that Goubaux dissected, he has never observed separation of the fragments. If the fracture is transversal, a piece of the bone may be drawn upwards; but when it is longitudinal the separation is ordinarily very small; the fibrous coverings which are over the anterior face of the patella hold the fragments in place.

With a closed fracture, pitched immovable bandages, made with bands placed above and below the patella, then crossed over the lateral faces of the region, or simply repeated blistering applications, are used; Delwart recommends two methods, which proved very good with him; with one, the horse is kept perfectly at rest for fifteen or twenty days, with his leg held slightly forward by a rope; with the other, an immovable bandage is applied over the whole region.

Andrieu has obtained the recovery of an open fracture. Toward the middle of the patella, there was a wound allowing the introduction of the finger, which could feel the fracture of the bone in three pieces; this wound opened in the patella sheath, and from it synovia escaped. Notwithstanding the severity of the lesion, treatment was undertaken with continued irrigation. After two weeks, walking exercise was begun; after a month all treatment was stopped, and the animal put to light work; a month later there remained but very little lameness in trotting.[1]

With open fracture of the patella, a *fenestrated* bandage with frequent antiseptic injections in the wound is the treatment to be recommended.

[1] A fracture of the patella is recorded by J. C. Meyer in which ligamentous union had taken place between the fragments of the bone, which at the post-mortem had been found, the external piece articulated with the external lateral surface of the femur, and the internal was resting in the fossa between the trochlea and the inner condyle. —American Veterinary Review, Vol. 6, p. 239.

Immobilization should be not carried to extremes; massage and early exercise will prevent articular indurations and muscular atrophy.

IX.—Tibia and Fibula.

Fracture of the tibia is one of the most frequently met with. The position of this bone in the skeleton of the hind leg exposes it particularly to kicks, principal occasional cause of the accident in horses. It is true that this fracture is always serious, but it is not necessarily irremediable, as considered by many. Many cases are recorded in our journals. In 1838 d'Arboral reported those of Tamisier, Duchemin, Géant, Mullon, Bettinger, Leblanc, in horses; of Mullon, Buisson, in cattle. The cases of Lavigne, Rossignol, Lafontaine, Poïsson, have added to the proofs already obtained of the possibility of recovery in cases of fractures of the tibia in animals. Every practitioner knows of its benignity in dogs.

The chances of success exist principally when the fracture is located in the lower third of the bone, when it is transversal and without displacement; fractures of the middle or superior part of the bone, the oblique one complicated with overlapping of the ends, are the most serious.

As in most fractures, interference imposes two indications: reduction and contention. If possible, reduce in the standing position. If the animal has to be cast, use anesthesia. For contention, use pitch, gutta-percha, plaster or the mixture of Piau.

In the horse treated by Bettinger, the middle part of the tibia was the seat of an oblique complete fracture. Reduction was made in the standing position: a first apparatus made of linen cloth, black pitch and rollers having become loose, the author made a kind of corset with a double piece of strong linen, between the layers of which several flexible splints were sewed, parallel to the leg and separated more or less from each other. This "corset" was padded on its inside and held in place by a roller. The bandage remained in place thirty-eight days. A chafed wound of the tendo-Achilles healed rapidly; the gait, stiff first, became normal gradually. Later, the callus was fired, and though he was a little lame, the horse was able to resume his work.

Leblanc has treated several fractures of the tibia. To place the horse in slings, lower the floor of the stall by a hole under the broken leg, make extension with a heavy weight tied to the foot, apply a bandage on the leg made of oakum, black pitch and splints, two of which are quite long and extending, the external from the foot to the stifle, the internal from the hoof to the upper third of the leg; such is the modus operandi he recommends.

With his apparatus (see *Fractures of the Humerus*), Lafontaine has cured a fracture of the tibia in a mare. In the same way, Poisson obtained the recovery in a nine months filly.

Lavigne threw down a young bull that he had to treat. With a rope tied on the thigh, he made counter-extension; with another fixed to the coronet he extended the leg and adapted the fragments together. To diminish the action of the muscles, he squeezed the tendo-Achilles on the tibia with bands of linen rolled several times round the leg. A piece of pasteboard, cut gutter-like, pitch, and splints from the hock to the lower end of the thigh, served to form a strong bandage. The patient was left loose, free to lie down and get up. After thirty days, the dressing was removed, the callus was formed.

Rossignol has published several cases of recovery of fracture of the tibia in swine and sheep. In one, the superior fragment protruded through the skin; it was amputated; a fenestrated bandage allowed the dressing of the wound with tincture of aloes. Oakum impregnated with a mixture of starch, alum and white of eggs, with splints and rollers, made a strong supporting apparatus. In the same way, Morin cured a heifer.[1]

According to Delwart, when the fracture is simple and transversal, success will always follow the application of an immovable bandage extending from the superior part of the fetlock to the patella. The bandage is reënforced with two strong splints, one external from the thigh to the fetlock, the other internal from the stifle to the same point. L. Lafosse has obtained the regular consolidation of a fracture of the tibia in a cólt, a calf, six pigs, three sheep and a large number of dogs.

In this last animal, those fractures recover very easily. Two pieces of pasteboard, cut in the shape of the leg and extending from the lower end of the leg to above the stifle, are applied over a pad of oakum enrolling the leg, and kept in place by turns of rollers coated with dextrine, silicate of potash or pitch. (See *Fractures of the Humerus.*) This bandage must be left in place from three weeks to a month. If it gets loose or becomes displaced, it is consolidated or replaced by another made in the same way.

With open fractures, the fragments are immobilized with an immovable apparatus, placed after careful disinfection and the wound well enveloped with wadding; but as the asepsy of the wound is often insufficient, a fenestrated bandage is preferable.

Fracture of the fibula exists most generally in common with that of the

[1] H. D. Fenimore delivered a calf which had a consolidated fracture of the right tibia near the lower third of the bone. The bone was bent a right angle and this deformity was the cause of the distokia of which the mother suffered.—American Veter. Review, vol. 21, page 566.

tibia. As a distinct lesion it is rare. External violence on the supero-external part of the leg may give rise to it; ordinarily there is no displacement; with a simple primitive bandage, consolidation takes place rapidly.

X.—Tarsus.

Fractures of the os calcis are rare; they are caused by external violence or muscular contractions. Jumps, slips, falls are the ordinary causes.

In general, their recovery is attempted only in small animals. In the large species the treatment demands often more than three months (Haase). However, recovery has been obtained in cattle, in a few weeks, by an immovable bandage of plaster or pitch and resine (Brauer, Detroye). The patient of Detroye—a fifteen months bull—in trying to cover a cow, raised himself on his hind legs: a peculiar noise was heard, like "that of a dry branch of wood breaking;" the animal falling suddenly, the os calcis was found fractured obliquely in the middle of its height. A strip of iron, gutter-like, adapted to the front part of the leg and extending from the middle of the leg to that of the cannon, was held in place with four straps, two above and two below the hock. Well padded inside, this bandage kept the hock extended and insured the coaptation of the bony fragments, thanks to the relaxation of the tendo-Achillis. It was removed after three weeks. At first the animal stood hesitatingly, but by degrees it improved and the lameness disappeared, notwithstanding a permanent deformity of the hock due to the callus. The result is not, however, always as satisfactory. A horse and a calf treated by the same author had to be destroyed.[1]

Fractures of the astragalus, still rarer than the preceding, is ordinarily the result of a sudden rotation of the hind leg on its axis, the foot resting on the ground and not obeying the motion started by the superior muscles; the tibia pivots on the astragalus, the median projection of the articular surface of the tibia breaks off the tarsal pulley. Möller has seen the lesion in a horse making a sudden volt. Furlanetto claims to have seen it in a cow that had fallen in a hole; he applied an immovable bandage reënforced by two wooden splints extending from the middle of the tibia to the fetlock; it was removed after thirty-five days. The animal remained lame for a year; there was a callus as big as the two fists.

In general with large animals, and from an economical point of view,

[1] *Os calcis.*—A case of open fracture of the os calcis without displacement was recorded by Harrison in which the treatment was simply keeping the horse in slings and local dressing to the wounds. The animal recovered.—Am. Vet. Rev., vol. 5, page 68.

the lesion is incurable. For small animals, a plastered or resinous immovable dressing should be applied.

Fractures of the other bones of the tarsus are generally observed only with luxation of the joint, which they sometimes complicate. Rey has published a case which occurred in a horse drawing railroad cars: the lower end of the scaphoid was fractured, the inferior part of the cuboid worn by rubbing, the external metatarsal separated from the principal and fractured in its superior third; the external ligaments and the interosseus were ruptured; the tendon of the flexor metatarsi was torn at the insertion corresponding to the fracture. Such accidents are of the most serious nature. Treatment is not attempted.

XI.—Metacarpus and Metatarsus.

Situated at the inferior extremity of the leg and rather unprotected, the cannon in our large animals is much exposed to traumatisms of all kinds, consequently to fractures; but its vertical direction and the small size of the region favor the chances of the treatment. The fragments, specially when the division is oblique, are generally but little displaced, and cases of complete recovery are rather numerous. Megnin has published the case of a horse, in which union took place without the slightest treatment, the bone being only slightly crooked and the callus large. Most ordinarily the manipulations of reduction are made standing, the fragments of the bone being in contact and the weight of the lower one sufficient to hold it in a vertical direction. In a few cases like that of Gombault, it is necessary to cast the patient. The deviations of the extremity must be avoided; the toe of the foot in solipeds and the interdigital space in ruminants will guide the manipulations.

A number of substances has been used to make bandages. Gerard, Conte, Gombault have recommended black pitch. The cannon is surrounded with oakum impregnated with the sticking preparation, so as to give it the size of the articulations which this bone coöperates to form; those joints are also protected with oakum from the pressure of the splints and guarded from cutaneous gangrene that might occur; splints, as long as the cannon (Gombault) or extending from the knee to the ground, so as to assist in the resting of the leg (Conte), are arranged upon that oakum and held by turns of pitched rollers. Delætre has advocated the white of eggs, bitten with camphorated alcohol; Marzac, a bandage made of starch, plaster, wire, and oakum; Rossignol, starch, alum and white of eggs; Stievenaert, the bandage of Delwart, with oakum, pitched rollers and splints.

But, without doubt, plastered dressing holds the first rank. Used first

by Bernard, then by Bonnefond, Vidal, Pujos, Bouley, Nocard, Morand, Furlanetto, Lucet, it is superior for fractures of the cannon. Pujos surrounded the leg, from the foot to the middle of the forearm, with bands dipped in wet plaster and rolled from downward upward. He put on three coats and thus made a cylindrical muff, sixty centimeters long and thirty-two in circumference. Removed forty-five days after, the animal stood firm; and two months after the accident the horse was not lame. Vidal applied first, upon the cannon, oakum dipped in a mush of plaster, then splints, one on the inside, the other on the outside, extending from the knee to the lower part of the fetlock and kept in place by plastered bands, and on the top of those a thick layer of plaster; a month after the horse resumed work; fifteen days later recovery was complete. Morand used about the same technic in a fifteen days old colt, suffering with fracture of the metatarsus; he removed the dressing in twenty days; union had taken place. On a twenty months steer, the same author applied a similar bandage, which was taken off after forty days. There remained a slight lameness, which disappeared later. The observations of Lucet and Furlanetto show that after thirty days a firm callus is almost always formed, in bovines. Simon has utilized gutta-percha in an eighteen-year-old horse. This animal died of colics on the twenty-third day of the treatment. At post mortem a temporary callus, very firm, had already formed. "Complete recovery, without deformity, would certainly have been obtained."

For colts, Rossignol recommends a very simple bandage which has given him numerous successes; cut a branch of willow, split it in two, gauge each half gutter alike and bevel the extremities; reduce the fracture and cover the cannon with a pad of oakum; apply the two wooden splints of willow and secure them with three pieces of wire twisted on the outside, one in the middle of the bone, the others at each end.

After all, fracture of the cannon is one of least gravity. It must be treated on animals of great value, specially if they are quiet and of small size; when the patient is light, the use of slings is not necessary. The patients of Gombault, Conte, Delærte, Morand, Lucet were left loose, lying down and getting up without trouble. The slings are advantageous while treating an adult, specially if he is heavy.

Sometimes, only one of the small metacarpal or metatarsal is broken. On a horse, Clichy saw it on the left hind leg. Both ends were in contact—there was no displacement. Pads of oakum with white of eggs and a pitch plaster were applied. After six weeks the animal was cured. In the case of Cauvet, the fracture of the external metatarsal of the right leg was complicated with that of one of the bone of the back. A suppurative arthritis killed the patient.

In dogs, the fracture of these bones gets well readily. A bandage left on from fifteen days to three weeks insures the union. Many practitioners employ starched or plastered dressings.

Compound fractures are treated by temporary antiseptic bandages or a fenestrated immovable dressing.

XII.—Phalanges.

Splits and phalangeal fractures are frequent accidents. There are few practitioners that have not seen numerous cases. In 1754, Lafosse, Sr., published nine observations of fractures of the second and third phalanges. Observation V. relates to a horse which, though having made no effort, "fractured in twenty pieces the os coronæ, without any injury to the os pedis or to the tendons." If traumatisms, jumps, violent strains produce them in a certain number of instances, there are cases where fracture takes place with a slow gait, after a simple mistep or even without apparent cause. Reul has related three cases of the coronet, occurring in horses in harness, "without fall or slip." We have often seen similar cases. But ordinarily, in such circumstances there is a split or a rarefaction of the bone.

The *first phalanx* is most frequently affected. Its fractures are transversal or longitutinal. Transversal, they involve its superior half. Fissures or splits start almost always from the median groove of the superior face (Peters); they extend to the lower extremity, or, again, they are oblique toward one of its borders; sometimes they occupy only a part of the height of the bone. Fractures are quite often comminuted; in a race horse, Dressler saw the first phalanx broken in nineteen pieces; Bonnard counted as many as thirty-four: "five large ones, five smaller, twenty-four very small." Roeder has seen a horse, which in falling fractured the first pastern of both fore and of the right hind leg. Wendworth has also seen on a horse the fracture of the first pastern on both forelegs. The fractures of *the second phalanx* are sometimes vertical, at others comminuted. In this last variety, the number of pieces varies from five to ten (Henon, Möller, Schrader). We have stated that Lafosse counted as many as twenty pieces. Henon speaks of a horse where it was broken in every one of the four feet. In some exceptional cases, the posterior border projecting beyond the superior articular surface has been found loose from the bone. Bascon and Dumont have seen that lesion on both forelegs. Lafosse, Huzard, Duliège, Adenot, Havemann, Kersting, Nocard, Trasbot have related cases of fractures of the *third phalanx*. Schrader has related cases of it with fractures of the ossified supplementary cartilage.

The diagnosis of a phalangeal fracture is not always an easy matter. When it is on the first phalanx, severe lameness, pain under manual exploration, swelling, abnormal mobility, crepitation, will assist in making it. If it involves the second phalanx, the hoof may interfere with the detection of the pathognomonic signs. The great sensibility to manipulation and twisting of the region is not always sufficient for a diagnosis. In the case of a fracture of the third phalanx following a deep punctured wound of the foot by a nail (Duliege, Trasbot), or after a keraphylocele (Nocard), the lesion may be easily made out. If the fracture is due to violent contusion or to a crushing of the foot, it may be suspected by the severity of the lameness and perhaps positively made out, according to the condition of the wall, which may be intact, broken through or entirely torn off.

Is there any advantage to treat *phalangeal fractures?* is a question upon which opinions differ much. Reul says it is altogether anti-economical "to treat accidents of this kind, when they occur in adults or old working horses. It is only proper to attempt it in colts or selected breeding animals or those of great value." Though this opinion is that of many, it seems to us exaggerated. In general, compound comminuted fracture should not be treated, specially if the animal is old and of little value; but, on the contrary, one is to interfere in cases of simple fracture upon young or adult subjects. It is true that union is always accompanied with the formation of an enormous callus, which interferes with joints and tendons and gives rise to lameness which is rebel to firing and blistering. But by neurotomy (plantar, high or double, median or sciatic), the lameness diminishes very much and the regularity of action may be restored. At present, there is in Alfort a thoroughbred which has been neurotomized, high and double operation, after a fracture of the first pastern: the result has been that for the last six years he does good work. Facts of this nature are not uncommon, and on this account we advocate the treatment of those fractures in a number of cases.

The tendons and ligaments of the region may be sufficient for perfect contention, specially for fractures of the os corona. Recovery demands rest, immobilization of the extremity or a blister over the digital region. With fractures of the first phalanx, when the fragments have a tendency to move upon each other, it is better to have recourse to plaster bandage (St. Cyr, Quinn, Rouillart, Möller). St. Cyr enveloped first the coronet and lower half of the cannon with a bandage covered with plaster mush; over this a second band and then a second coat of plaster; oakum dipped in the hardening mixture and a roller applied from downwards upwards completed the dressing. The animal was left loose; two months later union was complete; after three months, he was scarcely lame on walking; he soon resumed work. Quinn, in a fracture of one hind coronet, applied

plastered bands from the hoof to the hock, so as to form an apparatus four centimeters thick; after eighteen days the animal rested the foot firmly on the ground; a complete recovery was anticipated, notwithstanding the rather exaggerated size of the region. Johne has cured in two months a horse with transverse fracture of the first phalanx. Rouillard and many others have also obtained good results with plastered bandage. Gayot has seen recovery of a transverse fracture of the first phalanx of the right foreleg and a longitudinal fracture of the second of the left foreleg. Even bilateral phalangeal fractures do not constitute incurable lesions; still, even with the use of slings, recovery is very uncertain.

If the fracture is comminuted or compound, killing is imposed. Immovable bandages, antiphlogistic and antiseptic, give only half success. In presence of a fracture of the *second* or *third phalanx*, the veterinarian should prescribe antiphlogistics (cold compresses, cold baths, continued irrigation) or a blistering application; a strengthening bandage is not necessary.

In most of cases, as we have already said, union of a phalangeal fracture does not take place without the formation of a thick callus, a *ringbone*, which demands treatment. Blistering and firing are generally little useful. When after two or three months the lameness still prevents the animal from work, neurotomy is indicated.

XIII.—Sesamoids.

Although made of a thick layer of compact tissue, lined up with a fibro-cartilaginous padding, the *large sesamoids* may be fractured. Warnell, Salle, Dubos, Williams, Leisering, Rutherford, Schoneck, Möller, Delavenne have recorded many cases. In several observations they were animals kept for some time at rest on account of lameness; the accident being produced by a mis-step or a slip. Most often, it is during efforts of locomotion, specially jumping, that it occurs (Williams, Warne, Salle). Going at a full speed, the horse of Salle struck the left anterior fetlock with the hind foot of the same side. Immediately the animal was unable to stand on his leg, the bruised part became swollen and "shook loose" in walking. At rest the standing was normal. In a similar case, fractures of the large sesamoids were found (Schoneck, Möller, Delavenne).

Standing is almost impossible when the suspensory ligament is torn from its insertion on the sesamoids; at each step the fetlock drops down close to the ground. The perforans tendon may be more or less altered at its passage in the sesamoid groove. Sometimes the bones are broken in several fragments.

If treatment is attempted, it is better to apply a solid plastered or

gutta-percha bandage. According to the disposition and weight of the animal, he will be placed in slings or left loose. The local inflammation passed off, if lameness remains, firing or neurotomy (median or sciatic) is indicated. When several legs are affected, the patient had better be destroyed.

Fracture of the *small sesamoid* occurs most commonly as complication of old navicular disease or as the result of a punctured wound (nail) of the foot; it may also occur after a jump or under the influence of a violent effort. We observe it quite often in the feet of horses which are used for the exercises of surgery or of shoeing.

The diagnosis is very difficult. With wound from nail in the foot, it is only made out when the bone has been exposed. In a similar case, Humbert removed the whole bone and placed the horse under continued irrigation; three months after he was able to trot. This case, however, is unique. Möller has performed several times this *sesamoidectomy*, always with fatal results. If the fracture occurs without apparent cause, without traumatism, as in the case of Mollereau, positive diagnosis is impossible; the accident can only be suspected. The severity of the lameness, the sensibility of the foot and coronet to torsion and extension, allow only the affirmation of the presence of very severe lesions at the bottom of the foot.

Long rest, cold irrigations, later on neurotomy, constitute the treatment. The patient of Howell recovered only a long time after firing of the coronet. Notwithstanding the use of slings, blistering of the coronet, continued irrigation, the patient of Mollereau grew worse. It had to be killed. The small sesamoid was broken in several pieces, and the tendon of the perforans entirely ruptured.

IV.

PERIOSTITIS—OSTEITIS—OSTEOMYELITIS.

Intimately related in their anatomical connections and functions, made solidary of each other by the blood-vessels which penetrate them, the various constituting parts of bones—periosteum, bony tissue, and marrow—may be affected by the same morbid causes, altered in the same or in different degrees, according to whether they are attacked at once or successively invaded. It is also possible for the inflammation to remain localized a certain length of time or again during all its course only to the periosteum or the bony tissue itself.

Acute periostitis terminates in *resolution*, *suppuration* or the *passage to chronic state*. Resorption of inflammatory products and the return to normal state of the affected tissue is seldom seen. If the inflammation

becomes *suppurative*, the fibrous layer of the periosteum is loose from the osteogenous coat, a sub-periostic abscess is formed, sometimes a more or less extensive portion of the bone becomes necrosed. At the beginning of acute periostitis, one may endeavor to arrest the inflammation by cold. When the affection attacks a bone of the extremities, continued irrigation is a good way. In the very rare cases where pain continues to be very acute, suppuration is to be looked for; this detected, an early incision of the peri-bony tissues and of the periosteum must be made. The after treatment consists in antiseptic injections in the wound and a blistering friction over the diseased region. If the superficial layer of the bone is in course of exfoliation, injections with weak solution of muriatic acid (1 p. 100) are advantageous.

Chronic periostitis, limited, and very common, is *ossifying*, *osteoplastic* or *fibrous*. The first variety, which occupies the osteogenous layer and also, almost always, the superficial layers of the bone, brings on a more or less abundant production of *osteophytes*. It is that variety of periostitis which gives birth to exostosis, so frequent on the level of the insertion of articular ligaments in horses. Fibrous periostitis, ordinarily secondary, connected with a surrounding inflammation, is more peculiarly localized to the external coat of the periosteum, which becomes thick and unites to the surrounding tissues; often, there is at the same time a slight sub-periostic, bony neoformation, in the whole extent of the inflamed territory. When the affection is yet comparatively recent, if the pain is acute, cold lotions, baths or continued irrigation are useful. But one must not expect to control, by them, the bony neoformation. Massage, properly applied, associated with pressure, offers better advantages. Later on blisters, or firing with superficial or deep points, should be resorted to. Periostotomy, made when the affection is still recent, may reduce the pain, when it is severe; it has but a weak action upon the neoformed osseous tissue.

Diffused osteo-periostitis, generalized to most of the bones of the skeleton, those of the legs principally, is observed sometimes in dogs (Fig. 99). The affected bones are literally covered with bony growths, forming ordinarily a layer of nearly an even thickness, hollowed with narrow depressions filled by fibrous tissue. We have made autopsies on two dogs, in which all the bones of the legs were affected with these autogenic periostitis. In the museum of Alfort, there is a skeleton where these lesions are very interesting. In a case observed by Kitt, and where the histological characters of osteo-periostitis were missing, the author admits that it was a case of bony hyperplasia, myopathic in origin. The disease is rebel to all treatment.

Traumatic osteitis, promoted by efforts, contusions, wounds of bones,

fractures, are exposed or covered, according as the soft peri-osseous parts are divided or only bruised. *Covered osteitis* demands only rest, cold douches, compression, massage or resolutive applications. In the bony tissue, protected from germs, inflammation is slight, at first rarefying, then productive and ending in the integral reparation of the phlogosed tissue. With us it is a rule, with our patients, to apply upon the entire affected region a blistering preparation, which helps the development of the process. As we have said, the fracture of the weakened bone is the principal complication to be looked for. Hence the indication to keep the patient at rest for a more or less long time, according to the severity of the traumatism, and in serious cases, to keep him in slings. After recovery, there remains sometimes an exostosis whose treatment is the same as that of

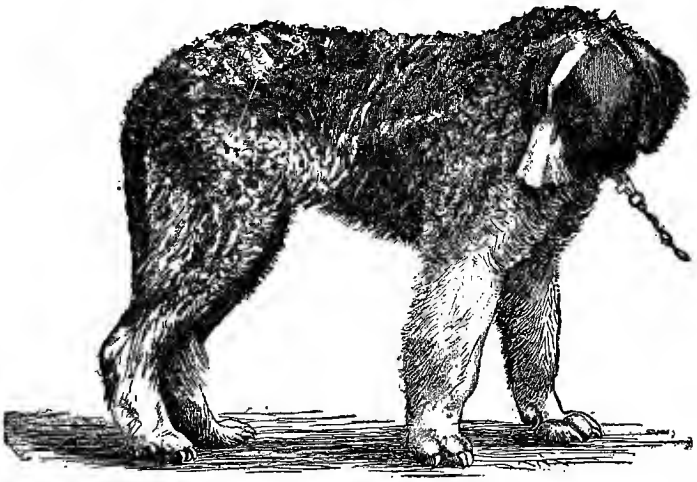


Fig. 99.—Dog suffering with osteo-parosis of the legs. (From a photograph.)

other osseous neoproductions. This termination is the rule with chronic osteo-periostitis. Covered traumatic osteitis may, however, end in suppuration, when pyogenous microbes are carried there by the circulation. But this termination is specially frequent in open traumatic osteitis. (See *Caries.*)

Actinomycosic osteitis is common, specially in the maxillary bones; *botryomycosic osteitis* is very rare. (See *Actinomycosis, Botryomycosis.*)

Tuberculous osteitis, frequent in man, is less known in animals. It has been specially observed in cattle and birds. It is rare on the diaphysis, but in preference occupies the epiphysis or the short bones. In bovines, it was seen on the tibia and the humerus (Moulè), the ribs (Moulè), the

cervical vertebra (Caudwell, Coremans). In birds, it is frequent, specially in parrots (Larcher, Eberlein). (See *Tuberculosis.*)

Glanderous osteitis, in horses, is actually without interest from the therapeutic point of view. We will only mention it. The abscesses which, in the course of this affection, occur in the periosseous tissues, may reach the bone and give rise to osteitis and osteomyelitis. There are cases where osteitis occurs without previous alteration of the surrounding soft tissues; the diagnosis is then sometimes very difficult. At the post-mortem of a glanderous horse killed on account of an incurable lameness of the left foreleg, Nocard found a voluminous abscess in the diaphysis of the humerus. This bone "seemed to have sustained a considerable swelling in all its superior half; a thick layer of fibrous tissue, indurated, lardaceous, infiltrated with serosity, surrounded it and was intimately united to it." In the superior part of the medullary canal, there was an abscess as big as a hen's egg.

Rheumatoid osteititis appears very rare in all species. It assumes, almost always, a chronic march, intermixed with acute access, of very long duration, and ends ordinarily by the production of an hyperostosis. Rheumatism of bones demands a long treatment; and when by the administration of salicylate of soda or other agents, the acute symptoms are controlled, alkalines and arsenic preparations must be used. With them a tonic diet and moderate exercise are essential. The local treatment, at most of little benefit, does not differ from that of simple osteitis; it includes blisters and cauterization.

Diffuse spontaneous osteomyelitis, which affects long bones near the epiphysar cartilages, is well known in man. Bacteriological researches have taught that staphylococci are its ordinary agents; other micro-organisms (streptococci, coli-bacillus, micrococcus tenuis) may produce it. It seems as if the pathogenous elements, carried by the blood, need an exciting cause to enter into action. A blow, a knock, is sufficient to create a center of less resistance, in which the micro-organism can come to proliferate and create lesions of the highest gravity. Epiphysar looseness, arthritis, prevalent and septic infections are the possible complications.

This disease is little known in animals. It was produced experimentally on young subjects by associating the trauma to the injection of staphylococci in veins. We have seen a remarkable case in a two-year-old colt. Cultivation of the bony marrow has given colonies of staphylococci.

When a single bone is affected, the disease recent, and the troubles not too great, treatment may be followed by recovery. (See *Caries* and *Necrosis.*) With diffuse osteo-myelitis, when specially several bones are affected, it is useless to undertake treatment.

V.

CARIES—SUPPURATIVE OSTEOMYELITIS.

This affection, known in veterinary practice under the name of *caries*, is essentially characterized by the interstitial suppuration of the bony substance, accompanied with necrobiotic manifestations and terminating with the complete destruction of the invaded bony structure.

Promoted by pyogeneous microbes, specially the *staphylococcus aureus and albus*, it corresponds to the *traumatic osteomyelitis* of human surgery —the term *caries* being applied specially to bony tuberculosis by surgeons.

Peri-osseous suppurations may be complicated with caries. Bony wounds made by soiled instruments generally bring on the same result. In animals, as well as in man, caries may be related to a general morbid state; it then may appear without apparent producing cause. Anyhow it is possible for the micro-organisms to be carried in bones by the circulation: Rodet and Jacoulay have produced osteomyelitis and bony suppuration by injecting cultures of staphylococci in the veins of rabbits. But, in the majority of cases, caries is due to local causes. The superficiality and the porosity of bones predispose them to it. In horses, the last phalanx, on account of its structure, the frequency of the traumatisms which affect it and the infectious processes that follow, furnishes the very great majority of the cases of caries met with in our practice. The navicular bone, the spinous processes of the withers, the maxillaries, are also frequently affected.

The treatment must have for object the rapid and complete elimination of the invaded bony structure, and the transformation of the morbid center in a simple bony wound, whose repair will go on rapidly in the ordinary way. There are two methods to choose: in one, exclusively surgical, the entire carious part is excised with the sharp instrument; the other, more conservative, consists in transforming the carious part into a true chemical scar analogous to the splinter of necrosis, likely to promote as it does, on its periphery, a moderate inflammatory process sufficient for its elimination. By this second mode, one, as Ollier says, attempts to "necrotize" the carious bone—to give it artificially the physical and chemical characters of the bone, necrosed spontaneously.

The use of either of these processes is dependent on various circumstances, specially the seat of the caries and the disorders it has given rise to. In all cases, however, it is indicated to interfere as soon as possible.

The treatment of caries by actual cauterization goes back to old time; it was freely used by old hippiatres, who had borrowed it from human surgery. Lafosse, who had seen many of its good results, said: "The red iron makes a non-contagious eschar and the suppuration, which follows its application, is a true knife with which nature separates the diseased from the healthy tissue." Cauterization not only makes eschars of the carious parts, but it creates in the surrounding region a true, eliminating and cicatricial inflammation. Repeated cauterization has often been used successfully in costal caries, which had resisted other forms of treatment. The operation must be done according to some rules: when the disease affects bones situated in the neighborhood of important organs (cranium, ribs, extremities of long bones), the cauterization must be done slight for a few moments, done at several seatings, one or two days apart, to such effect that the heat would not penetrate as far as the organs that these bones cover or protect; spongy bones should be burnt for a longer time than those that are dry or compact, on account of the great quantity of fluid which, escaping for the first, rapidly put the heat out, and also because caries affects them more deeply.

A great number of chemical caustics have been advocated against caries; emetic (St. Cyr), chloride of zinc, nitrate of silver, more or less diluted mineral acids, specially sulphuric (Pollock, Mollereau). We do not like this treatment. Not only are those agents powerless to arrest the caries, but they may give rise to severe disorders in the soft parts which cover the diseased bone.

Every time that one wishes to interfere directly and easily upon the diseased bone, he must proceed with the removal of the carious tissue. This is the way that all caries of the third phalanx must be operated. There, the operation consists in exposing the tegumentary membrane that envelops the phalanx, in freely excising all portions of the velvety and podophyllous tissues, which are gangrenous or on the road to mortification; then, with a sage knife, the drawing knife or a curette, remove layer by layer the part of bone that is dead, until the surface exposed gives evidence of its vitality and perfect integrity by its normal resistance, its rutilant coloration on exposure to the air, through the bloody oozing which comes from the areolæ of the spongy tissue all over its surface. When this presents still in some points a bony tissue with a brown, purplish or yellow-greenish color and if pressure brings on the oozing of some traces of pus or sanious fluid, the curette must hollow all these points, until sound spongy tissue is reached; it is better to scrape some of this than to have the smallest portion of diseased tissue left behind. Often, after trying to preserve a thin layer of the os pedis, one is obliged, two or three days later, to make a large cut in the foot, remove a wide piece of the

tegumentary covering and cut deeply into the phalanx. It has been recommended to limit the scraping of the carious part inside the limits of its extent, and to complete the operation by the application, on the diseased part, of a small wadded tent impregnated with caustic fluid, such as sulphuric acid diluted to the third or the quarter. These caustic solutions were supposed to have the great power of limiting their action to the extent of the altered structures. We have already stated how erroneous this belief is. It is better to be done with the caries at once, to scrape down to healthy tissue and apply an antiseptic dressing. In cases of caries of the third phalanx, when, exceptionally, the podophyllous and velvety tissues are sound, they must be respected: their preservation is of the utmost importance for the repair of the new hoof. In such instances, the fragments of the membrane corresponding to the caries must be carefully dissected to expose the diseased bone (Bouley). In other circumstances, the periosteum must be carefully saved. It should be separated carefully from the bone, so as to preserve it and have it co-operate in the formation of new bone. Upon the saving of the internal cellular layer of the periosteum depends, indeed, the regeneration more or less rapid and perfect of the destroyed bone; daily practice in human surgery proves it sufficiently. Very extensive alterations may necessitate amputation in small animals. The special rules of the treatment of caries in some regions are indicated in the chapters relating to those affections. (See Vol. II.)

The general indications, so important in the caries of man, are, however, secondary to all animals. Yet in dogs there are cases where it is advantageous to administer cod liver oil, quinine, Fowler solution or alkalines.

VI.

NECROSIS.

Necrosis, dry caries, dry gangrene of bones has a complicated etiology. In animals traumatism is a great producing cause. Bones of the extremities are, on that account, most exposed; the radius and the tibia are those where it is generally observed, by the fact of the frequency of the contusions to which they are exposed and their want of protection on their internal face; phalanges, scapula, sternum, maxillary, offer also frequent examples.[1]

Several diseases, distemper among them, are sometimes accompanied with

[1] An unusual case of necrosis of the dorsal vertebræ is reported by F. Allen, D. V. S., which gave rise to progressive paraplegia in an old horse, which ended fatally, and at the post-mortem of which the annular portion of the 7th, 8th, 9th and 10th dorsal vertebræ were more or less necrosed.—Amer. Vet. Review, vol. 8, page 360.

bony lesions, bringing with them more or less extensive mortification; lead and phosphorus poisoning must have the same nocive action in animals as in man, but facts to this effect are wanting.

The size of the *sequestrum* varies much. Sometimes it is but a very small piece of bone, or even small fragments (parcellar necrosis); in some cases (panosteitis) mostly the whole bone is affected. Sequestra are *exposed* or *invaginated*. The museum of Alfort contains several specimens of invaginated scapula. We have seen two beautiful ones in Lyon. On a horse affected with comminuted fracture of the scapula, Chuchu extracted first a few splinters, then after two or three months, a sequestrum from the anterior angle of the bone. In the observation of Barrier and Gervais, it was a mare which had received a kick on the anterior border of the right shoulder, about twelve centimeters above the shoulder joint; a blister was applied and the patient put to rest; the lameness, first slight, increased little by little; extremely serious symptoms became manifest, the animal dropped in the slings and was killed. The necrosed scapula was covered with an osteo-cartilaginous envelope of new formation. Jacquot has reported the case of a yearling colt, convalescent from distemper, which received a kick on the superior part of the forearm; the fistulous wound that followed was treated by blistering and antiseptic injections; an enormous swelling occurred with other numerous fistulas from which escaped an abundant suppuration. He was destroyed. At post-mortem an extensive necrosis of the radius was found with sequestration of the necrosed portion.

If all denuded bony surface is predisposed to necrosis, infection plays with it the primordial part. A piece of bone, deprived of circulation, but aseptic, is tolerated by the tissues; it does not promote suppuration, it may become grafted, and the characters of this aseptic necrosis are very different from those of infectious mortifications. Therefore, as soon as a bone is exposed, isolated from its periosteum, it must, after minute disinfection, be covered with an antiseptic preparation (iodoformed, phenicated or boricated vaseline), which prevents its desiccation and protects it from external agents.

When mortification exists, the treatment includes four indications; 1st, hasten the limitation of the necrosis; 2d, favor the elimination; 3d, prevent infections; 4th, activate the repairs. When necrosis has affected but a very limited and superficial surface, as is seen frequently with some bones, simple antiseptic injections are sufficient to prevent all complications; by the local reaction alone, the sequestrum is eliminated and the loss of substance is rapidly filled up. In bygone days, escharotics and caustics were frequently used; some exclusively employed tincture of iodine or Villate solution in injections through the fistula; others cauterized it

with the red iron. (Fig. 100.)[1] To-day, phenicated water, liquor of Van Swieten, chloride of zinc (10 p. 100) are mostly used. Though the sloughing of the sequestrum takes place slowly, there is no need to remove it with sharp instruments. Leave the work to nature. Often the gouge or the dressing knife would remove too little or too much of the tissue. However, if it was feared that the inflammation might spread to other important organs, it would be advantageous to excise the dead part and

Fig. 100.—Necrosis of the scapula. S, sequestrum. (Specimen of the Afort School.)

stop only when healthy tissue is reached, easily recognized by its aspect and the blood that oozes over the section. With these exceptions, the disjunction must be left to take place spontaneously.

During the time that the separation between the dead and the living tissue goes on, some special cares are necessary to avoid complication. Abscess should be open, purulent undermining freely cut at dependent

[1] In the museum of the American Veterinary College there is a specimen similar to that represented in Fig. 100, the entire scapula being enveloped and moving loose in it.

parts and drained; frequent antiseptic irrigations will prevent purulen resorption.

As soon as delimitation is operated the pus changes aspect; fron serous, it becomes whitish, thicker; at that time, if the sequestrun is isolated and not incarcerated, nothing is easier than to extract it After free incising, it is taken hold of with forceps and brought outwards —*Phalangectomy* has been performed by Garcin (1834) on a mule, suf fering with a nail in the foot; the os pedis, entirely necrosed, was hel only by "a very small ligamentous band," it was removed entirely; afte four months the animal "was returned to work, and though lame, wa able to do it for two years after." In a heifer suffering with nail in th foot with necrosis, Delafond, in 1838, performed *sesamoidectomy* "Nineteen days after, there was scarcely any lameness, the animal re covering completely."

The operation is also easy when the bone, though invaginated in a thicl bony box, communicates with the exterior by a large opening, through which it may pass; it can be secured and brought out with forceps When the cloaca are narrow, recovery is more difficult; it necessitates *sequestrotomy* or *necrotomy*. If the sequestrum is left to itself, suppura tion becomes abundant and the patient becomes weak; but hasty inter ference is dangerous; the bony envelope must be of a sufficient strength not to break during the manipulation of the operation—a point of great importance, should it occur on bones of an extremity.

Interference decided upon, the soft parts are divided, in saving blood vessels and nerves, and the incision connecting all fistulous tracts together as much as possible. The region being chronically inflamed, the hemorrhage is always abundant; esmarchisation, or at least a rubber cord placed at the upper part of the leg, are good precautions. Reaching the bone, the periosteum is dissected loose, and then, with the trephine or the gauge and mallet, a piece of bone is removed, wide enough to permit the ex ploration of the suppurating cavity. Sometimes one meets with a dia physis entirely necrosed, then he is obliged to enlarge the opening, "to remove the cover of the bony coffin where lays the dead diaphysis." In such cases, it is prudent to divide the sequestrum, so as not to reduce to excess the resistance of the protective envelope. The cavity is curetted, irrigated, plugged with iodoformed gauze; antiseptic dressings favor the complete repair of the trauma. One can conceive the disturbances that such operations demand and how long must recovery be. In very young subjects, where repairing power is great, success is possible; but often lameness remains, incompatible with economical exploitation of animals For this reason, in large animals, abstention is the rule, even when the extraction of the sequestrum is easy.

To avoid the always serious operation of sequestrotomy, chemical agents have been recommended to obtain the dissolution of the necrosed tissue. Some twenty years ago, Pollock recommended in man, the use of sulphuric acid mixed with its weight of water. Painted over with this solution, the sequestrum becomes soft, brittle, it is partly dissolved and the rest is eliminated by suppuration. Marcacci recommended perchloride of iron to activate the delimitation. For him, this agent irritated the healthy living structure and promoted the formation of numerous capillary vessels which soon isolated the necrosed from the living parts. Morris more recently has advanced another process. The fistulas being enlarged with the knife, he injects a solution of muriatic acid (2 or 3 p. 100), which dissolves the calcareous elements of the necrosed bones without acting on the living ones. A chlorhydropepsic solution thus used and composed of: muriatic acid, 16 drops; pepsine, 2 grammes; distilled water, 120 grammes, digests the caseous and fatty detritus remaining of the decalcified bone. In using alternately both solutions, the sequestrum is rapidly destroyed and recovery obtained.

In preference to these chemical treatments, the more rapid and more certain operating methods are generally in use.

During all the time of the treatment, the patient should receive generous diet, stimulants and tonics. The progress of the disease should be carefully watched, and the complications likely to occur avoided.

VII.

EXOSTOSIS.

Result of a productive osteo-periostitis, exostosis are particularly frequent in the extremities, where many receive special names. In a general way, the name of *exostosis* is given to well defined bony tumors; that of *periostosis* to diffused neoformation; that of *hyperostosis* to the increase in size of a bone in its dimensions. In the point of view of their structure they are divided into: 1st, *eburnated exostosis*, containing no blood vessels; 2nd, *compact exostosis*, formed of dense tissue; 3d, *spongy exostosis*, made of areolar tissue. In relation to their seat, they are *epiphysar*, developed on the surface of bones; *parenchymatous*, formed in the thickness of the bone; *enostosis*, occupying the medullary canal.

For a long time, observers have noticed that exostosis developed specially on a level with the surface of insertion of the principal ligaments; *osselets*, on the points of attachment of lateral or interosseous ligaments; *splints*, on the line of interosseous fibres; *ringbones of the pasterns*, near

the point of ligamentous insertions. Exostosis of the rachidian column take place also at the insertions of the inferior common vertebral, interspinal or articular ligaments (Goubaux and Barrier). Whatever may be the power of a muscle, exostosis are almost never found at the point of insertion of its terminal tendons. The few exceptions to this rule are met with in tendinous cords, which on some parts of their course play the part of ligaments. These facts are easily explained, if it is thought that the ligaments of extremities have to support the reactions from the ground, while tendons stand only the more or less powerful actions of the muscles they terminate, which is far inferior to the great traction that the whole mass of the body, sometimes loaded heavily or animated by rapid gait, gives to the agents having for duty to hold the articular surface in relation (Barrier). Traumatisms are frequent causes of exostosis. Violent pressures, surrounding inflammations, youth, heredity, play a more or less important part in their development. Let us mention the exostosis called *osteogenical*, appearing without evident cause, and among them, in particular, the cranian exostosis met often in bovines (Goubaux).

The manifestations given by exostosis vary according to their seat, age and size. Renault has seen in a horse two bony growths of the frontal portion of the cranian cavity which gave rise to immobility, by pressure upon the brain. Neyraud has mentioned a case of paraplegia due to strangulation of the spinal cord by an intra-rachidian exostosis. Bony tumors of the pelvis, often following fractures, may wound or perforate the bladder or the intestines (Bouley Jr., Coulbaux, Patu) or interfere considerably with parturition (Favre).

But the most frequent and most important exostosis, from the point of view of practice, are those that develop on the bones of the extremities of our animals used as motors. During the whole course of the osteitis which prepare and develop them, they may interfere with tendons, disturb the regular functions of joints, press upon blood-vessels or nerves.

After Hunter and Cooper, some authors, to make bony tumors disappear, have recommended the administration of diluted *mineral acids*—a poor way which has never given good results. If success has been claimed, it must be attributed to the evolution of the organism alone. The existence in young horses of bony growths which are temporary, and are resorbed with age, is well known. Many practitioners, Liard and Gillibert among them, have mentioned cases of spontaneous disparition of these exostosis. In general, however, those tumors are tenacious. To obtain their resolution, blisters and alteratives have been recommended. Tincture of iodine, charge of Lebas, that of Girard, have had their day. To-day, cantharidis blister, that of mercury, red ointment, are the preparations most in use. Bichromate of potassæ, tried first by Neff, Fœlen, has

given good results to Schmid, Peuch, Lamouroux. It is made in proportion of 1 to 16, 1/8, 1/4, 1/3. "The bony tumors, which like ringbones and callous spavin, frequently give rise to tenacious lameness, demand friction, repeated often with ointment, 1/4 to 1/3.... If one uses an ointment to the 16th, 12th or 8th, and rubs it slightly a few days apart, the treatment will leave no mark. If, on the contrary, a stronger ointment is used, if the frictions are frequent and severe, the bulbs of the hair are destroyed by the caustic, and the animal more or less blemished. The slough of the eschar is always slow; sometimes even, when the quantity of bichromate is very small, it falls off unnoticed. In some cases, however, there is formation of a small quantity of pus."[1]

The numerous topics with secret composition, liquid fires, liniments, ointments, pomatums, praised against bony blemishes, have no superiority over the mercurial blister or ointment of biodine, which remain the agents most commonly used. There is some advantage to percute the tumor slightly with the plessimeter before applying the blisters. Flagellation and massage, already used in old times, have again been recently advocated by Félizet. Pressure over the tumor is a method of Lafosse, reintroduced by Möller. It is seldom used. When blistering has failed, firing is indicated. It has been advocated under all its forms: in superficial points, lines, deep points. We prefer this last mode, which reaches the bone itself and gives rise in it to high inflammation; we pierce the skin through with one or two strokes of the cautery, penetrate into the bony tumor and cover the cauterized surface with a coat of blister. Praise of the penetrating points needs not to be made. Rey, Leblanc, André, Lavendhomme, Foucher, Abadie, have proclaimed the excellence of the method.

But there are cases where cauterization fails: it is for them that the bistouri has been recommended. Sewel, professor in the veterinary college of London, invented, to produce the resorption of exostosis, the division of the periosteum on their surface. This operation—*periostotomy*—has been used but little in France. To perform it a kind of bistouri having a strong blade with convex sharp edge and blunt point is used; at the base of the exostosis an incision is made in which the periostotome is engaged; pushed flat-wise under the skin, until it reaches the superior border of the tumor, the sharp edge is then turned on its surface and the periosteum is divided. According to Sewel, only a slight inflammation follows, and after ten or fifteen days the animal can resume its work. Reynal has obtained no good results with this operation. Bouley found it advantageous for subcutaneous growths, as splints, but "it is not the same with those situated under a complex fibrous apparatus, as ringbones and spavins, which cannot be interested in their thickness without having first divided

[1] Peuch, Journal de Med. Vet., 1868, p. 440.

the thick coat of tissues, rebel to the inflammation, which covers them; and besides that, for certain ringbones as for some spavins, the immediate neighborhood of the articulations is one of the most important circumstances which make us reject the idea of the application of periostotomy, as being at least useless and certainly dangerous." We will see that there is indication for it, that it may render service and that, performed antiseptically, it is harmless.

The ablation of bony tumors is seldom performed. The operation, easy for pedunculated growths, is difficult for the others, that have a broad base of attachments on the bone. It is reserved for some exostosis against which other means would be powerless, specially those of the face. Incomplete side bones are quite frequently removed, and when a portion of them is necrosed. As for the gouging out, with the mallet and gouge, in cases of phalangeal exostosis, splints, spavins, etc., it is a condemned method.

Neurotomy performed above the fetlock, the median or the sciatic, according to the localization of the exostosis, is a last treatment which may succeed when firing has failed.

Exostosis are quite common in birds. They develop in preference on the bones of the legs, sometimes those of the trunk; either without apparent cause, or after traumatisms. Hyperostosis of several regions of legs have been observed (J. Hunter). Muyschel and Adamovics have related cases of generalized hyperostosis in gallinaceous (Larcher).

Special Exostosis.

I.—Osselets.

Bony tumors of the knee, *osselets* are generally situated on the lateral faces of that region and on the head of the metacarpals. They represent high splints, a name under which they are commonly known. More frequent on the inside than the outside, they may be double, and in that case the internal one is more developed than the external. They are sometimes situated in front of the knee, on the bones which form that joint. When they are in large number, and in connection with the presence or the absence of synovial dropsies, the knee is said to be *hooped*.

The prognosis of those exostosis varies very much according to their seat. Developed on the anterior and lateral faces of the knee, they interfere with the movements of the joint, produce a pseudo or partial ankylosis and a more or less lasting lameness, while those located on the metacarpals, like splints, generally produce only temporary lameness.

More serious than ordinary osselets is the exostosis, met in race horses, which is spread on a level with the trapezium and the tendons inserted upon it. This exostosis, almost always following an effort, a partial lacera-

tion of the tendons at their point of insertion, gives rise to a lameness of long duration, due to the periostitis and tendinitis, while it grows and interfering with the function after its full development. On a three-year-old that we watched the lameness lasted fifteen months. On another, for two years after there remained some stiffness at the start. Most of the practitioners who have seen this lesion believe that it is the sequelæ of a fracture of the suscarpal bone.

As soon as the diagnosis is made by the lameness, the sensibility and a slight swelling of the part, rest must be prescribed. If blistering and firing do not obtain the removal of the bony neoformation, they often have the advantage of removing the lameness. For osselets that resist firing, median neurotomy is indicated.

II.—Spavin.—Tarsal Osteo-arthritis.

The hereditary transmission of some defective conformations of the hock (narrow, bent), perhaps also a want of resistance, plays an important part in the development of spavin. Through the efforts of pulling, rapid traveling, rearing, jumping, the articulation of the hock receives pressures liable to injure the ligaments, synovials and bones; specially in young animals, whose organs have not reached their full development, these are the principal causes of the disease.

If spavin is sometimes only a high placed exostosis, most generally it invades tarsal articulations. In that case, it is at times superficial, due to ligament tears, and forms on the lower tarsal articulations a kind of callus, assisting ankylosis (Aronsohn); at others, and more frequently, it is the expression of several dry arthritis which result in the ankylosis of the inflamed joints. According to the seat of the bony tumor, we consider the *metatarsal spavin*, occupying the superior part of the internal face of the cannon, and the *tarso-metatarsal* or articular, spreading over the articulations of the hock. This last offers several varieties: in the first, the external tumor and the ankylosis are limited to the articulation of the cuneiform bones with the metatarsal; in the second, the lesions involve also the joint of the scaphoid and cuneiforms; in the last, the astragalus is united to the scaphoid. In a similar way, spavin is spread more or less transversely and when its dimensions are reduced, its prominence is situated at times forward, towards the bend of the knee, at others more backward.

During the development of spavin, when the lameness is already very great, often no abnormal projection is detected at the base of the hock; morbid sensibility is very little marked or absent, which renders the diagnosis difficult and shows that the lesions truly began in the bottom

of the articulations. At this stage, the pains due to the osteo-arthritis a often very great. In walking, there is a sudden flexion of the hoc analogous to springhalt. However, this symptom is quite rare, and still may be observed when there is no alteration of the tarsal articulatio That which is most frequently seen is an abnormal, more or less marke stiffness of the hock. The sudden flexions of the cannon increase t lameness; sometimes the animal falls when turning short. But the phenomena are not characteristic. Many *latent spavins* are diagnos only by exclusion and by the old ideas of extreme frequency hock lamenesses. It is often only after six weeks, two months or ev

Fig. 101.—Spavin, seen from forward, left leg.

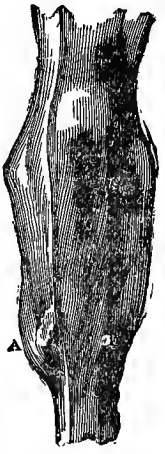


Fig. 102.—Spavin, seen from behin right leg. (Goubaux and Barrier.)

later, that, on the ordinary seat of spavin, a bony tumor, gradually increa ing, is detected. Then the pains resulting from the arthritis being muc reduced, the lameness diminishes little by little.

Without doubt, spavin is one of the most severe lesions of the locomoto apparatus. One of the most authoritative old hippiatres has said "Any horse with one or two spavins of steer will never be useful." Th prognosis varies with the age, size and situation of the tumor. Observa tion has taught that spavins are so much more serious and rebel to trea ment that they are situated more forward and nearer to the fold of th hock. We must not count on the "*restituo ad integrum*" of the invade joints; but in a large number of cases, one succeeds in removing th lameness. Authors who, like Lemichel, claim that "spavin never fo gives," have evidently exaggerated the rebel tendency of the affectio

The removal of the lameness is obtained in the greater half and even two-thirds of cases.

When osteo-arthritis of the hock is considered the cause of a recent lameness, when a spavin is suspected, long rest is the primordial indication. Even at the outset, it is at least doubtful if long immobilization will succeed in obtaining the disappearance of the inflammatory symptoms with which the *subastragalian* joints are affected, so that everything will return to its normal state. In most of cases, a relative recovery only is obtained—

Fig. 103.—Spavin. Front view of dissected hock.

Fig. 104.—Vertical transverse section of a spavined hock.

simple or multiple ankylosis, limited or extensive—and all the treatments recommended act satisfactorily only in favoring it; existing articular lesions, even recent, are incurable.

By rest and blistering applications (mercurial blister, red ointment, sublimate ointment 1 to 6) on both faces of the joint, the lameness may be made to disappear, when the spavin is tarsal and on the way to development; as soon as the animal is returned to work, the lameness returns. Blistering frictions, even repeated, have a too superficial action;

they seldom give a successful result. It is an error to hope that by their use one will succeed in changing or arresting rapidly an articular inflammation, which has its productive conditions always present and will feel their action as soon as work is resumed.

The application of these agents subcutaneously has been recommended (Bassi, Buch). Bassi makes over the spavins two or three cutaneous incisions, converging downward, scarifies the subdermic connective tissue and then applies the blister.

The empiric mentioned by Cattrall made a longitudinal incision on the skin of the spavin, separated it from the tissues underneath forward and behind, then introduced powdered sublimate in the wound, which he sewed with three stitches. Often the slough of a piece of skin, the opening of the synovial or a bony necrosis were the sequelæ of this treatment.

Setons, recommended years ago, are to-day almost completely abandoned. To them blisters and later on firing have succeeded.

Cauterization has a stronger and deeper action than blisters. Lines or superficial points have their advocates; but it is better to abstain from using it in recent spavins. Gerlach has studied comparatively superficial and deep firing, and condemned the latter, which he said exposes to arthritis. Modern practice has rehabilitated needle firing. Arthritis is to be feared only when the operation is badly done and the joints are not yet protected by periostosis; when the osseous neoformation exists, the entrance of the point is not to be feared, when made on its surface. It is known anyhow that fine points or needles can without danger perforate articular synovial. Möller, who claims to be a partisan of deep cauterization, passes his cautery one, two or three times in the point, and often completes the operation with a blistering friction (sublimate ointment 1 to 6). Hoffmann applies over the exostosis fifteen or twenty points down to the bones. Bottazzi, as well as Nanzio, employed the subcutaneous method.

Several special operations have been recommended against spavin.

Abildgaard, Hering, L. Lafosse, have advised the *section of the cuneal branch*. The operation is very simple. The animal thrown on the lame side, the opposite leg is secured on the corresponding forearm. The line of incision is indicated by the vertical axis of the internal face of the hock; operating too much forward, the saphena vein or the articular bursa might be injured. The growth itself gives the best point of repair; if it is small, the band is felt over its surface; if large, it is ordinarily divided in two portions by a transversal groove, at the bottom of which the band is situated. Sometimes this is raised, stretched or more or less deviated by the growth. The hair being clipped, a vertical incision is made with the convex bistouri on the selected region, with a length of 4

r 5 centimeters. When friction or firing have been applied, the skin nd subcutaneous tissues are indurated, and sometimes a thick layer of ubcutaneous structure has to be divided before the tendon is exposed; the emorrhage is quite abundant. The index finger introduced into the ound detects the tendons, it is raised with scissors introduced underneath t, divided with the bistouri and a piece of it amputated. The wound may be eft open or is closed by one or two stitches. The synovial flow soon ecomes purulent and may last for two or three weeks, but gradually isappears.

There is often advantage to combine tarsal tenotomy with firing. Immediate relief, spoken of by Lafosse and Mandel, must not be expected. Getting up, animals are ordinarily as lame after as before the operation: it demands a certain time for the beneficial effects to be seen. The mode of action of this tenotomy is complicated. Not only does it make the tendinous cord loose, the pressure of which was one of the causes of the lasting lameness; but it also activates the inflammatory process and thus hastens ankylosis, in case of recent osteo-arthritis. On these accounts it is indicated, no matter what are the size, the situation or age of the exostosis.

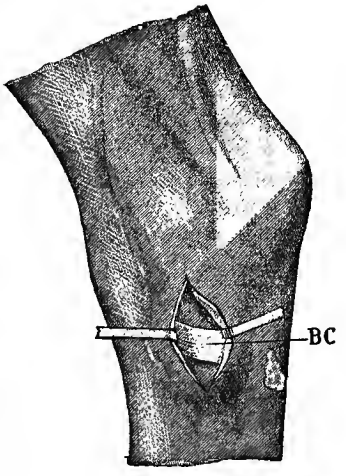


Fig. 105.—Cunean tenotomy, BC, Cunean branch.

Dieckerhoff has advised the dividing of the cunean sheath from the fold of the hock or origin of the tendon to its insertion on the cuneiform; he operates with the bistouri, the animal standing. After the operation, quite a large swelling is formed; the wound suppurates; cicatrization takes place in two, three or four weeks. Two weeks later, the animal can be returned to work. In 1875 he made known the results of this practice, and out of thirty-six cases of spavin with lameness operated upon, twenty-one made an almost complete recovery, eight were improved, seven failed.

Periostotomy of Peters has given Möller good results. Here is the *modus operandi*. The internal face of the hock well exposed, the hair is cut on the lower parts of the region, on a level with the spavin; the skin is aseptisised. With the bistouri a narrow incision is made, on the inferior line of the hock, towards the middle and transversely to the internal face, through which curved scissors are pushed under the skin, first upward and forward, and then upward and backward; thus forming two tracts arranged

in V shape. A curved bistouri then introduced into these tracts divic the tissues covering the exostosis and encroaches upon this; passed the front tract first, with its sharp edge turned backward to avoid inju to the vein, then brought over the surface of the bone, with pressu on the back of the instrument, the fibro-tendinous tissues are divid and the superficial layer of the exostosis incised. Withdrawn, it is th passed in the posterior tract, where the same manipulations are execute Treated antiseptically, the wound heals in a few days ; no cicatı remaining. When, by exception, suppuration occurs, there is no serio sequelæ following. Several times Möller has carried the instrument in the bones without the slightest complication. A rest of four or six wee is necessary. It has been advised to place the animal in slings to preve his lying down. This therapeutic method does not claim to alwa cure spavin, but it does not seem to deserve the reproaches cast on by Schutt. Möller has obtained by it many successes. When the result incomplete, firing can then be used.

Neurotomies tried by many have generally failed. The same has be the case with the section of the flexor metatarsi when made a hand's wid above the hock (Klemm).

Although shoeing occupies but a secondary place in the treatmen Klemm, Möller, Kösters, recommend to apply a shoe with long and thic heels.

For cases where the tarsal lesion is complicated with knucklin after proper shoeing, treatment will be applied at once on the spavin ar the phalangeal deviation—this last by tenotomy. (See *Knuckling*.)

III.—Jarde—Jardon.[1]

These two expressions are not synonymous. The latter is situated c the external face and back of the hock in the hollow existing in th region. The former is applied when the exostosis, more developed, pr trudes beyond the posterior line of the hock, which, instead of beir straight, describes a curve more or less marked, on a level with the hea of the external metatarsal. It is proved to-day that this deformation ca be due to several causes: sometimes to the head of the bone which more developed and more angular than usual, as seen in the progenitu of some stallions. That which is commonly taken for a jarde is but fibrous tumor, true tendinitis of the perforans (Barrier); but here e ploration does not give the feeling of a bony tumor. As remarked b Jacoulet, growths situated on the posterior face of the principal metata sal, at the origin of the suspensory ligament, or the dropsy of the tars

[1] This is the "curb" of English authors.

sheath and some small cysts of that region, may give the impression of their being true jarde. The researches of Gillet, Sipierre, Goubaux and Barrier seem to establish that it does not attack the joints of the hock; but always remains limited to the head of the rudimentary metatarsal or to the ligament which unites it to the principal metatarsal; a localization which explains its benignity, known for long time and so expressed by Lemichel: "Jarde forgives always; splints sometimes; spavin never." Some authors, however, claim that it may invade the tarsal joints and produce a certain tumor of ankylosis analogous to that of spavin. Whatever it may be, it is certain that few jardes give rise to lameness of any duration and seldom do they require treatment. Lameness is great and lasting only in cases where there is complication of ankylosis or when there is lesion of the perforans.

Fig. 106.—A, Jard. (Goubaux and Barrier.)

Astringents and cool applications are rarely used. Blisters and deep cauterization are indicated at once. When there is false jarde (cyst, tarsal or thoroughpin), an oily fluid escapes through the points.

IV.—Curb.[1]

Old writers called *curb* the exostosis which develops outside and back of the hock. To-day, notwithstanding the remarks of Palat and Sanson, all authors agree in giving that name to the bony neoformation developed on the inner side of the lower extremity of the tibia, reserving that of *jarde* and *jardons* to those of the external and posterior faces of the hock.

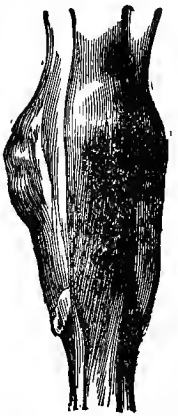


Fig. 107. — Curb. (Goubaux and Barrier.)

Curb is a rare exostosis. It is ordinarily due to traumatisms and lacerations of the ligamentous apparatus of the internal face of the hock.

The diagnosis is easy, even when the tumor exists on both legs. On its internal face, the lower extremity of the tibia is larger and wider than normal.

Generally there is lameness only during the period of development of the exostosis: in some cases where it remains longer, the bony inflammation having reached the articular surfaces of the hock, the prognosis becomes more serious.

The treatment of curb does not differ from that of other exostosis. At

[1] This seems to us the "high spavins" of English authors.

the beginning, blisters, bichromate of potass ointment, ordinarily removes the lameness; sometimes the tumor is resorbed. If these means fail and lameness persists, deep points firing is indicated.

When, by exception, curb extends down the hock, it may give rise to incurable lameness.

V.—Splints.

They are observed generally on the front legs, sometimes on the hind legs. Their frequency in horses recently put to work was well known to old hippiatres. Among young horses, which work on pavement, at fast gait, many become lame after a few months. Examination of the foot and of the leg often reveals no lesions; the shoulder is suspected; but this lameness, in horses recently working, has ordinarily for cause a superficial inflammation of the metacarpal bones. Indeed, there soon appears upon the region, along the rudimentary bones, a slight swelling, first puffy, which soon becomes well defined; it is a periostitis of the cannon. In many of these lame individuals, for the first few weeks, it is very difficult to detect even by repeated examination the location of the pain (Abadie). Percussion with the plessimeter is not as good to make it out as hand examination. The history of the case is important; ordinarily it is that of a horse put to work for a few months which has exhibited some temporary lameness. If the foot is not the seat of some morbid sensibility; if the coronet, the tendons and the fetlock are clean; and if, on the other hand, the region of the small metacarpals is infiltrated or painful, *splints* are developing.

When this growth is complete, and the bony inflammation has passed, the splint does not produce lameness, except in cases where, placed behind the principal metacarpal, it presses against the suspensory ligaments and interferes with the play of tendons or the action of joints. "Splint does not produce lameness, but when it attacks the styloid bones or becomes so large that it presses against the tendons lodged between those bones," it does (Lafosse). "The callus running upward behind the knee lames the horse" (Solleysel).

Against growing splints, several authors recommend cold baths, pressure, frictions of camphorated alcohol, embrocations of populeum, emollient poultices, repeated mercurial frictions. These means are little used, but the application on both faces of the metacarpus of a mercurial blister or of biodide of mercury ointment is preferable. The alcoholic solution of sublimate, the ointment of bichromate of potash (Peuch, Lamouroux), may also be used. There are cases where the bony inflammation disappears rapidly and where no exostosis is formed; after a few weeks, the horse returns to work. In others the sensibility remains acute or

he splint becomes more or less developed; blistering preparations are necessary.

Hammering with the back of the hammer of the plessimeter, followed by a blistering application, succeeds in a number of cases. The whole surface of the splint is hammered with light strokes, without bruising the skin, and then a blister put on.

When, by blistering, one succeeds in reducing or removing the lameness, although the tumor remains, the animal may be returned to work. It is useless to try to obtain the resolution of the exostosis by firing; as remarked Lagardere and Liard, it often resorbs spontaneously as the animal gets older.

To obtain the "melting" of splints, massage and pressure have also been used (L. Lafosse, Möller). This is done by the application of a piece of sheet of lead or thick leather which is applied on the exostosis and held up by turns of rollers. Often, in a few weeks, the exostosis has diminished in a noticeable manner. The dressing is renewed every day; the skin must be carefully watched to avoid the necrosis.

If these means fail, cauterization must be resorted to—actual firing in lines, superficial or deep points. Notwithstanding the remarks of Liard, we use this last mode; like Abadie and many others, we have obtained very good results with it. We puncture the skin through by one or two strokes of the instrument, and apply a stiff blister to complete the action of the firing.

Periostotomy, recommended by Sewell, has been successful with Bouley, Haubner, Williams, Dammann, Ehlers. It must be performed aseptically, to avoid accidents by necrosis. During the eight days following there occurs a slight inflammation. According to Sewell, the animal can resume work eight or ten days after the operation; often the growth is resorbed entirely.

Ablation of splints is possible only for those that are projecting, pedunculated, or situated far from the tendons. L. Lafosse has done it with chisel and hammer, "without having any accident to regret and without blemishes afterwards."

Median neurotomy may relieve splints that resist all those means of treatment and in which the lameness persists.

English authors call *sore-shin* a peculiar affection of the cannon bone, which is common in race-horses. According to Cagny, it is specially frequent in colts of eighteen months to two years; it is rare at three and absolutely exceptional in older animals. It always began during training. The excessive lameness that it gives rise to, when one leg only is affected; the peculiar mode of standing of the subjects when both legs are suffering, may lead us astray in the diagnosis, and make believe to be navicular disease.

or acute laminitis. But soon there appears on the anterior face of the cannon a diffuse and painful tumefaction.

The nature of this affection is still a subject of discussion. Williams, Cagny, Möller, believe it periostitis. Abadie has described it as "tenositis" of the extensors. Weber says it is due to a lesion of the extensors and of their sheath.

Whatever may be its nature, the prognosis of the trouble is not serious. Treated at once by blistering application, everything disappears, leaving no mark. If, on the contrary, training is kept up, the symptoms increase; a hard diffused tumor is formed on the anterior face of the cannon, which resists cauterization. Still, it does not seem to disturb the action of galloping (Cagny).

Rest is the first indication of a rational treatment; blistering does the rest. Seldom is firing required. Williams advises subcutaneous periostotomy, which, for him, would diminish the duration of the lameness. In some cases where the operation has been made with insufficient asepsy, periostitis has become suppurative and complicated with partial necrosis of the principal metacarpal.

VI.—Ringbones—Sidebones—Phalangeal Exostosis.

Under the name of *ringbones* are designated exostosis of the phalangeal regions. According to their location, they are divided into those of *the pastern* and those of the *coronet*. These are divided into *phalangeal*[1] and *cartilaginous*.[2] Those exostosis present great interest from the surgical point of view; as long as they develop, they give rise to lameness, which often lasts long, because the growth interferes with the action of tendons and ligaments, or presses painfully on the tissues of the foot.

All the causes likely to give rise to producing osteo-periostitis may bring on those exostosis; among them particularly are efforts of locomotion which, through the stretchings of the ligaments, irritate the osteogenous coat; violent reactions of the ground, dry arthritis, chronic inflammation of the peri-bony tissues, diffused exostosis of the pastern and coronet. After splits or fractures of the phalanges, or after the operation for deep nail in the foot, they are frequently observed. Bony neoformations developed on a level with the insertion of ligaments, near the articular surfaces, sometimes spread and mingle together, surround the joint and bring on a false ankylosis.

While ringbones are often seen on the hind legs, sidebones almost exclusively belong to forelegs. "Everyone knows the special affinity that fibro-cartilaginous tissue has for the elements of bone. As soon as

[1] Ringbones. [2] Sidebones.

scutiform layers are inflamed, lime chalks are deposited in them, bony

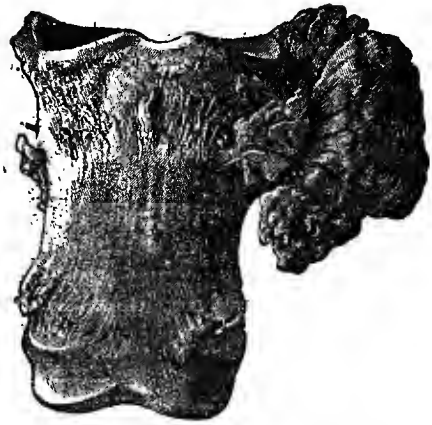


Fig. 108.—Phalangeal Ringbone.

degeneration takes place " (Bouley). Violent reactions, not proportioned to the resistance of the tissues, traumatisms, wounds on the coronet, car-

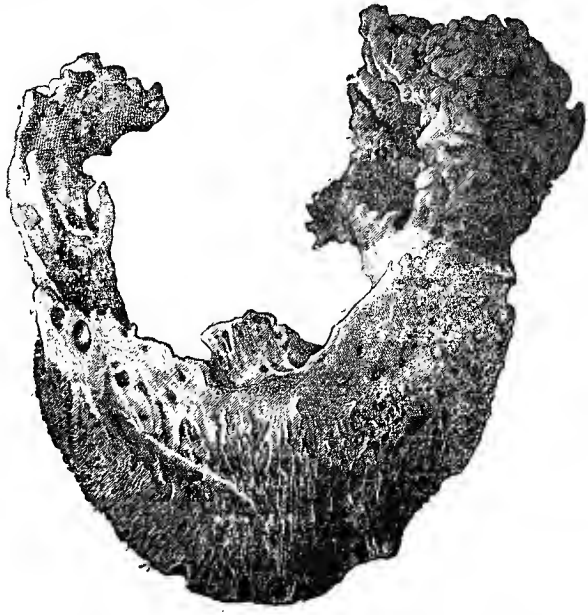


Fig. 109.—Sidebones with atrophy of the third phalanx.

tilaginous quittor treated by caustic injections, are as many causes of this ossification of fibro-cartilages. Among the other etiological influences

must be mentioned the bad formation of the foot, the vicious direction o the pastern, improper shoeing, heredity. Flat feet are much predisposec to sidebones. Tapon does not believe in the influence of heredity mentioned by the majority of authors; for him sidebones of colts ar due to permanent stabulation.

The diagnosis of these troubles, like that of splints, is often difficult a the beginning. All the *lameness of youth* are not due to periostitis of th cannon; there are those which have for causes phalangeal periostitis o incipient ossification of the cartilages, and sometimes a slight tumefactior of the pastern or coronet with an abnormal sensibility are scarcely detectec by careful exploration.

The prognosis varies much according to the size of the growth, its origin its situation. If, in general, large exostosis produce stiffness or permanen lameness, there are many small ones which produce no pain, no func tional disturbance. Periostosis produced by articular phlegmasias are, by the fact of the ankylosis which follows, extremely dangerous. In general phalangeal exostosis which are limited, are specially serious when they ar situated low, interest the horny box, are within it; cartilaginous exostosi are so much more serious that they are more anterior.

To pare the foot in such a manner that the standing of the digita region be firm and normal, apply a proper shoe (Coleman or bar shoe according to the form of the foot), avoid excessive work, violent reactions or the pavement for young subjects, whose tissues are not yet fully developed raise the colts in liberty: such are the principal indications of the pro phylaxis of those tumors. Turning out would often be followed by th resolution of incipient sidebones. Tapon says that he saw three colts kept in stabulation, have exostosis in two weeks; they were turned out they disappeared on one, diminished on another and remained in th third.

The therapeutics of these diseases includes numerous methods amon which a choice must be made. Often one is consulted at their beginning when there exists only a little thickening, or an abnormal sensibility. Col baths, continued irrigation, poultices, astringent applications, and res sometimes give good results; but blistering frictions are generally pre ferred. They hasten the march of the disease and shorten the duration o the lameness. Ointment of bichromate of potassæ has been beneficial witl Fœlen and Peuch.

When the exostosis is formed, it is yet to alteratives that one must resort If blisterings may relieve the lameness due to a young tumor, made o spongy vascular tissue, they are generally powerless with old, hard an compact growths. Cauterization itself, though more powerful, is truly goo only against recent growths; it is applied in lines, superficial or needl

points. But it remains powerless with old, large or eburnated exostosis. To relieve sidebones, with firing are associated a proper shoeing and grooving of the foot (Weber). Lameness is partly due to the pressure of the tissues situated between the horny structure and the bony growth. To relieve the pains and help the dilatation of the posterior parts of the foot, division of the foot is resorted to. Ordinarily three grooves perpendicular to the ground or slightly oblique downwards and backwards are made in the quarter, on the side where the growth exists. Another mode consists in making, one centimeter below the coronary band, an horizontal groove, from the heel to the anterior boundary of the sidebone, and two others converging slightly downwards: the superior has for object to permit the expansion of the coronary band. These grooves must not extend to the soft tissues, as they might bring on podophyllitis, necrosis, caries of the os pedis or a cartilaginous quittor. By daily applications of hoof ointment, tar or a dressing, the desiccation of the hoof and the formation of seams are prevented. Zundel, Humbert and others have recommended the thinning of the quarter with the drawing knife or the rasp; the effects are the same on the painful region, the results are good. Sidebones producing contraction of the plantar region, special shoes indicated against this ailment shall be applied. In general, the bar shoe is recommended, with paring of the heels and relieving the quarter from pressure on the diseased side. The shoeing of Coleman-Poret is also very advantageous. As soon as the inflammatory phenomena due to cauterization have passed off, it is indicated to use the animal to slow walking exercise. By degrees the horny box spreads, the pressure diminishes, and the lameness may disappear notwithstanding the fact that the tumor remains. When the sidebone is very large, if one will not resort to *neurotomy*, a portion of the quarter can be extracted, extending from an oblique line made in a direction backwards and downwards from the coronary band a little in front of the sidebone. After a few weeks, the animal is returned to work. The foot spreads below the exostosis, the new-formed quarter does not press as painfully as the old one; the lameness diminishes and sometimes disappears.

Extirpation is only practicable with sidebones and only in cases where the unossified part of the cartilage is affected with necrosis. Thin the quarter, isolate the coronary band on a level with the tumor as in the operation for quittor, cut it at its base with the narrow drawing knife, raise it, separate it from the tissues underneath, carefully avoiding the synovial cul-de-sac; such are the various steps of the operation. Mangin has advised to divide the coronary band to operate more easily and to use a blunt bistouri to loosen the growth. The classic method is to be preferred.

We will mention *periostotomy* only to proscribe it. It never gave but bad results.

When ringbones and sidebones remain rebel to the treatments we have considered, neurotomy may be resorted to, to remove the lameness and render the animal useful.

Low neurotomy—the division of the posterior branch of the plantar nerve—is not sufficient. The operation must be made above the fetlock, so as to destroy the sensibility below it.

To perform the *metacarpal* or *metatarsal neurotomy*, the animal is cast and the leg secured accordingly. If the operation is to be made on both sides, the inside is operated first; the animal being turned over to complete the operation on the other side. When the fetlock and the inferior part of the cannon are free from disease, the nerve is readily felt, alongside the lateral face of the tendons, a little above the fetlock. If the swelling prevent its detection, the line of the incision shall be made along the border of the cylindrical mass formed by the tendons. The region prepared, the skin and cellular tissue are divided (2½ to 3 centimeters long); the nerve is isolated with the bistouri or the grooved director; taken hold off with forceps, the bistouri is introduced underneath it with sharp edge turned upwards, and the nerve divided towards the superior extremity of the incision; the free portion of the nerve is then amputated below. The wound is closed with one or two stitches, covered with collodion and a wadded dressing.

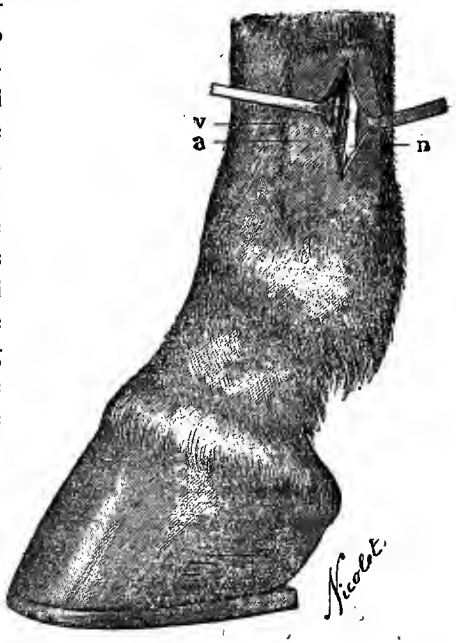


Fig. 110.—High neurotomy, n, nerve; v, vein; a, artery.

Some horses, as soon as up, are free from lameness; in others, this does not disappear except by degrees. When asepsy has been used there is no complication to fear; cicatrization takes place rapidly. Sometimes the lameness is only reduced, which is due to the recurrent sensibility or a stiffness of the articulations; in these cases double or low neurotomy is indicated. It must be double where there are phalangeal peri-

ostosis or sidebones on both sides. The patient must be left to rest one month to six weeks, and the senseless foot must be watched for the traumatic lesions that may occur in it. If the foot affected with exostosis is the seat of acute symptoms, neurotomy is to be postponed until these have subsided.

Renault in 1831 already mentioned the advantages of this neurotomy. Rey says he has used it often and obtained many satisfactory results with it (1867). Yet its use did not spread. It was accused of promoting softening of tendons (Goubaux), producing slough of the foot. In 1881–83 Nocard rehabilitated its use. He obtained many successes with it and never had an accident. Yet, he performed it on both sides, taking all necessary precaution; such as: operate on legs free from acute inflammation of the feet, give the animal from five to six weeks of rest afterward, remove only a short piece of nerve, about one centimeter, so as to obtain as quick as possible nervous regeneration, which returns to the leg a portion of its sensibility.

Many practitioners, Trasbot, Benjamin, Jacoulet among them, have been less fortunate. With them, high and double neurotomy has been followed with diffuse gangrenous inflammation and slough of the hoof. Even if performed on one side, it has not been entirely harmless. It is true, these accidents are exceptional; and the fact must not be lost sight of that the operation is performed only on patients that have resisted all treatments and were useless. Therefore, notwithstanding the complication of sloughings of the foot with which the operation is credited, we never have hesitation in performing it for large unilateral exostosis, rather than to lose time with useless cauterization.

Let us add that contraction of the heels, which so frequently complicates the disease, often disappears after a few months, through the free function of the extremity. Nocard and Mollereau have shown that after the operation, the side of the exostosis sometimes diminishes in large proportions. In a horse treated by them, the bony tumor had, after six months, lost more than half its dimensions.

High, single or double neurotomy, is not the only one that can be used. Peters, Goldmann, Blanchard have obtained good results with *median neurotomy*. Sensibility is not abolished in the external half of the foot; still, most commonly, lameness subsides.

With phalangeal exostosis of the hind leg, *high* or again *sciatic* neurotomy is indicated, when firing has failed.

These exostosis sometimes occur upon the anterior and lateral faces of the toes of cattle (Cruzel, Faulon). As in the horse, they are due to efforts or traumatisms. Generally they are only on one toe, and give rise to lameness, hence their seriousness.

At first, cold applications are resorted to (continued irrigation, cold or astringent compresses). Later, blisterings, specially with the bichromate of potass (2 to 4 parts in 30), fine points of needles cauterization.

Often, by simple change in shoeing, the lameness can be relieved and the animal be able to do his work or be fattened (Faulon). To this effect, the diseased toe is relieved from carrying weight; the height of the hoof is reduced by paring it low, no shoe is put on that side; while on the contrary the hoof of the sound side is left untouched, and a pad of leather placed between it and the shoe. It is prudent to exercise the animal for some time on soft ground. In some cases, like Gutteridge, neurotomy has to be performed.

VIII.

RACHITISM.

This expression must be reserved to name the softening of bones in young animals, and that of *osteomalacia* for the same alterations occurring in adults. These two morbid conditions seem to have similar causes and the differences observed in the lesions depend invariably on the condition of development of the diseased bones; in osteomalacia, the bone, already calcified, loses all its lime salts which are taken up by the circulation and eliminated, while the alterations in rachitism are the result of an insufficient calcification.

Relatively frequent in young dogs and pigs, rachitism is observed sometimes in colts, calves, sheep, wild carnivora kept in captivity (lion, tiger), monkeys and gallinacious. The special conformation of the members of some species of dogs (the basset), considered by Daubenton as the result of rachitism, arrested in its progress and afterwards transmitted by heredity, is no longer considered as pathological, but as a character special to this breed. Yet rachitism is frequent in dogs, specially the Danish. Young pigs of improved breeds (English and other crossings) seem predisposed to it. Ordinarily the disease is manifested by general symptoms and local troubles. The alterations of bones vary much. On the extremities, epiphysar swellings are observed, the bones are bent; the front legs, deviated forwards, backwards, outwards or inwards, assume special aspect. The vertebral column may be curved upwards (cyphosis) or downwards (lordosis) or sideways (scoliosis). Bony growths are sometimes seen at the union of the ribs and their cartilage (rachitic bead) or on the sternum (chicken chest). The bones of the cranium present in some cases fontanels. In pigs and young goats, the maxillaries are swollen. The same occurs in horses. The case of Laquerrière, was that of a four years old horse, in which both jaws were affected. The little mare mentioned by Soula was affected when three years old. The branches of

the lower maxillary had lost their consistency; the superiors were swollen. Mastication was impossible, in a three-year-old mare seen by Benjamin and Redon.

The pathogeny of rachitism is yet obscure. L. Lafosse accuses bad hygienic conditions, damp habitations, those badly kept, exposed to the north where sunlight never goes. Feeding with fodder poor in calcareous substances has been incriminated. Guerin, Roloff, Voit, Chossat, Milne, Edwards, have produced it artificially in dogs and pigs, by submitting them to a *régime* poor in lime salts. But Tripier and Weiske, who renewed the same experiments, failed in obtaining the same results. For some authors, Heitzmann among them, the rachitic bone is decalcified by lactic or phosphoric acid; the administration of the first by the digestive canal and in subcutaneous injections has produced the disease in young carnivora (dogs and cats). The negative experiments of Toussaint and Tripier upset this theory. Is rachitism the result of an inflammation of the bone? and does phosphorus, recommended by Kassowitz, give rise really to a beneficial inflammatory work? Is there always, at the beginning of the disease, dilatation of the stomach and digestive troubles, as said by Comby? Those are as many unanswered questions of the day. Rachitism is after all but the result of a unique cause; it is the result of a "degeneration with numerous causes." All that which weakens a young subject, that disturbs its nutrition, favors the softening of bone. Lafosse has remarked that the invasion of the disease occurs with the time of weaning; hence the indications not to deprive the young subjects too early of the mother's milk, which alone possesses the digestible qualities necessary to the stomach of the newly born. Potatoes in great quantity predispose pigs to rachitism. Roll has seen it in young lions fed with meat, free from bone. The same has been observed in dogs.[1] "The too simple uniformity in food free from condiments, and specially want of outdoor exercise and natural light,

Fig. 111—Rachitic goat. (From a photograph.)

[1] On two occasions, the translator had the opportunity to witness corroboration of the remark of Roll. A large litter of cubs being left to a lioness to nurse, the little fellows became rachitic after being weaned and being fed with boneless meat. Most of them died except two which were fed artificially with plenty of bone dust, but they remained always deformed, and more or less weak.

seemed to have played a prominent part in several cases that I have observed in dogs and goats." (Trasbot.)

The prophylaxy is indicated by the consideration of those etiological conditions. The hygiene and the good quality of the food should be watched. A diet as rich as possible should be prescribed. To palliate the insufficiency in the proportion of phosphate of lime, a greater quantity of grain should be given in each ration. If diarrhœa occurs, the ordinary treatment is indicated.

The curative treatment is complicated. It is proper to prescribe the soluble preparations of lime, specially the chlorhydro-phosphate or the lacto-phosphate. In syrup shape, these preparations are given in doses of two or three tablespoons a day for a dog of middle size. As adjunct, bone dust, in two or three tablespoons according to cases, should be given. But Springer has shown that mineral substances, to be utilized by the organism, must be combined with the treatment. Phosphate of lime obtained from the mineral kingdom, as well as the phosphates of bones, can not be absorbed; they can be found entire in the fæces. The author advises a decoction of cereals of which he gives the formula: Place in four litres of water, two tablespoonfuls of each of the following: wheat, oats, barley, rye, bran, corn; boil them for three hours, filter and add water to make a litre.[1] This decoction may be used for all animals, specially for dogs. For herbivora it is better to give the grains in nature. Since Bretonneau, cod-liver oil has been recommended by numerous practitioners; it is an analeptic tonic containing iodine and phosphorus. In dogs, the dose is one or two tablespoonfuls a day. Kassowitz has recommended phosphorus (1 milligram a day for dogs, 1 to 5 centigrams for large size colts.) It could be given dissolved in sweet or cod-liver oil:

Cod-liver oil.....	100 gramme.
Phosphorus.....	1 centigramme.

All that can brace the appetite and stimulate nutrition must be used. Iron-tonics, quinine, gentian, are to be recommended. Salt is very good for sheep and calves.

L. Lafosse advocated blistering applications upon the swelling of the head and irritating frictions (alcohol and spirits of turpentine) on the legs. To prevent the deformity of the bones of the legs, he also advised, at the beginning of the disease, the application of splints or plasters. The general treatment is far the most important.

When improvement begins, the lame patient gets up more willingly and walks, the appetite returns; the bones that were flexible, harden, but remain

[1] Springer, Semaine Medicale, 1894, p. 393.

bent; however, it frequently happens that after a certain time, by regular exercise and good diet, the deviations of the bones disappear almost completely. As soon as the bony nutrition is reëstablished, at both extremities of the bent diaphysis, the bone grows straight, the periostic appositions take place most exclusively in the concavity of the diaphysis, to such an extent that after complete development, the bone has a normal shape.

When, on the contrary, a deformity remains upon one of the bones of the extremities, there is no hope to straighten it except by *osteoclasia* or *osteotomy;* operations which will never enter in our surgery. What is difficult, is not to break up the bone—the osteoclasts of Colin and Robin answer that purpose (osteoclasia),—or to divide it with shears after incision of the skin (osteotomy); but to keep them in good position. Our patients are restless, they constantly move and displace their dressings; the regular union of the separated ends would be uncertain. Therefore, with them, the treatment of rachitism is almost exclusively medical.

Rachitism is not very rare in birds kept in captivity or domesticity (Larcher, Mégnin.) It is observed specially in chickens, pheasants, turkeys, pigeons, ducks, geese and blackbirds. It appears ordinarily in the first months of life. Sometimes all the bones are affected, at others it is limited to a few, habitually to the bones of the trunk (vertebræ, ribs, sternum, pelvis.) Life outside, strengthening diet, stimulating frictions of the legs (alcohol, hot wine), such is the treatment to follow.

IX.

OSTEOMALACIA—OSTEOCLASTIA—OSTEOPOROSIS.

Some authors describe in special chapters *osteomalacia, osteoclastia* and *osteoporosis.* Osteomalacia, seen in horses, dogs, and goats, is characterized, as we have said, by the softening of bones in adult subjects. In osteoclastia, special to bovines, there is no softening, no deformation of bones; the spongy substance is partly resorbed and the medullary canal increased. Osteoporosis consists specially in a dilatation of the Haversian canals with resorption of the compact bony substance. Germain has observed this affection upon our horses in Cochinchina, with an enzootic character. Most pathologists, with Friedberger and Fröhner, make no difference in those affections; they consider them only as morbid forms having causes of similar order, from which at last results an abnormal fragility of the bony tissue, due to the resorption of its spongy, of its compact substance or of its calcareous salts. This fragility is principally observed in bovines (cachexia ossifraga.)

The disease begins either by rheumatismal pains or by synovitis: these

were frequently seen by Germain. After a certain length of time, the maxillaries become thick; the face is swollen, its normal shape gives place to a more or less marked enlargement. Respiration and specially mastication becomes difficult. The subject dies in a state of marasmus. The different bones of the legs do not present any malformation during the life of the animal. In cattle, the head is rarely affected; the legs are, more commonly, and on that account the animal assumes the decubital position. With a capricious and diminished appetite, there is paresis of the hind legs, perhaps fractures of their bones may occur; but it is exceptional to meet with their softening or their deformation.

The causes of these pathological conditions are about identical. A fact commonly noticed in bovines, is, that the disease attacks, ordinarily, exclusively cows in gestation or in full lactation; which is attributed to the great deposition of lime salts demanded by the skeleton of the fœtus and the production of milk. Males are almost never affected. Another fact, as common, is the localization of the affection to some countries. It is invariably in regions where the ground is poor in phosphate of lime that the disease occurs. Cantiget has published the analyses of various soils, which are very demonstrative:

	Soil where cachexia does not exist.	Is at times prevailing.	Where it is frequent.
Nitrogen.....	7.184	3076 to 2164	3016
Phosphoric acid.....	4.048	1280 to 1.32	940
Potassia.....	14.688	5100 to 5.032	1.464
Lime.....	245.952	1.0752 to 2.5872	9.148

Inquiries as to the quantity of phosphoric acid contained in hay grown on each of those soils gives the following result:

1st. 2 kilog. 500 gr. of hay from a soil where cachexia is frequent give about 170 grams of ashes containing 2 grams p. 100 of phosphoric acid;

2d. The same quantity of hay from soil where the disease is rare, gives about the same quantity of ashes, but 2 gr. 70 and 29 gr. 80 p. 100 of phosphoric acid are found;

3d. From the soil free from the disease, there are less ashes (145 to 150 grams), but those contain 3 gr. 85 p. 100 of phosphoric acid.

These analyses, as well as the results of the intervention they have given rise to, show evidently that poverty of soil and hay in phosphates is the producing cause of bony cachexia. Hence, the indications to supply the soil with calcareous salts and specially with chemical manures rich in phosphates and superphosphates. The experiment needs no longer to be made; it has been carried out by many practitioners, who all have seen the disease disappear. Youth, gestation, lactation are only predisposing

causes. Therefore, it seems possible to-day, by "treating" the soil alone, by furnishing it with the wanted phosphates, not only to prevent but to cure "cachexia ossifraga." Emigration to lands where the disease does not exist is also a means to obtain rapid recovery of the sick animals.

The diet must be changed. Instead of fodders reaped on those poor soils, cereals, leguminous, such as oats, beans, peas, all the substances rich in lime salts, should be given. Oil-cakes are also to be recommended. By stopping the milking of cows so as to dry them; and again by not having them covered, the consummation of phosphate of lime will be diminished; but these are measures that can be only exceptionally applied.

The medicamentous therapeutics, less important than the diet, must not, however, be neglected. Cod-liver oil (200 or 300 grams a day for cattle) is indicated, but its high price is an objection. Phosphorus in cakes of 1 to 5 centigrams a day, dissolved in cod-liver oil, has been advocated by many and quite recently by Bass. Cereals, grains must be preferred to phosphate of lime or bone dust which are so often recommended (Springer.)

Bitter and iron tonics (gentian, cinchona, water with rust of nails, etc.) stimulate the appetite and strengthen the animal. Local symptoms (articular swellings) should be treated by frictions of warm vinegar, camphorated alcohol, spirits of turpentine.

In woman, castration has given encouraging results. It deserves trial in our large females, in the districts where osteoclastia exists.

X.

TUMORS.

From the clinical point of view, it is advantageous to divide the tumors of bones into *benignant* and *malignant*, without distinction of the numerous groups established by pathological anatomy. *Lipomas* and *myxomas* of bones are almost unknown in animals. *Fibromas* (*?*) have been mentioned in the walls of the maxillary sinuses of horses and in the inferior maxillary of cattle (Zundel). *Chondromas* (enchondromas and perichondromas) are more interesting. Gurlt has seen them in the superior and inferior maxilliaries of horses, goats and dogs; Röll in sheep and horses. Kiener and Peuch have published an interesting observation of osteoid chondroma. *Perichondromas* only justify extirpation. If they do not interfere much, it is better to leave them alone; when they produce lameness, as in chondromas of the paws in dogs, they must be extirpated; if the lesion extends deeply, in the thickness of the bone, amputation is indicated. In the case of Kiener and Peuch, after firing, the tumor developed on the inferior

extremity of the radius, became as big as two fists, the leg swollen to the shoulder, the animal walked on three legs, dragging the other flexed. Notwithstanding amputation, the animal died.

Most authors deny the existence of *epithelial* or *primitive carcinomatous tumors* of bones; these neoplasms starting on a point where epithelial tissue exists, the bone is invaded only secondarily. In horses, on the bones of the face, epitheliomas are quite frequently seen which have for starting point vestiges of the epithelial dental structures inclosed in the superior maxillary. We will return later on to those *tenebrating epitheliomas*. Myeloplax sarcomas are met as primitive tumors of bones, as shown by Megnin, Trasbot and our own observations. Developed on one bone of the leg, sarcoma deforms the region and gives rise to lameness. Sometimes the bony lever, unable to support the weight of the body, breaks under it. The only treatment likely to offer some chance of success is complete ablation of the tumor and amputation. When a tumor is developed on a claw of dogs or cats, disarticulation at the metacarpophalangeal joint may be followed by recovery; but most ordinarily the metacarpal has also to be removed. Trasbot treated a greyhound in this manner successfully.

Various tumors have been found in birds. Von Bibra has related the case of an exotic bird which had an enchondroma of the stinsum; and Laborde one of osteofibroma in the claw of a chicken (Larcher). We have ourselves found osteo-sarcoma in chicken and pigeon.

XI.

HYDATIDS.

Only a very small number of observations have been published of *echinococci of bones* in domestic animals: two in horses and seven in cattle (Neumann). In the case of Colin, observed in horse, "the hydatids formed in the sub lumbar region an enormous tumor which had invaded the muscles of that region; it returned after two partial removals, one extended on the ilium; echinococci were found in the diploea of the bones."

The therapeutics of these cases is poorly established. If the diagnosis was made and interference possible, the cystic cavity ought to freely opened and curetted. The vesicles are disseminated in the spongy tissue: it is very difficult to remove them all, and one overlooked is sufficient for a relapse. Scraping of the bone ought to be done as deep as the healthy tissue; here, the best surgery is that which goes beyond the seat of the disease. The wound afterwards should be disinfected and covered with an antiseptic dressing.

CHAPTER XII.

ARTICULATIONS.

I.

CONTUSIONS.

The severity of contusions depends on the nature of the interested tissues, the intensity of action of the injuring agent, the thickness of the muscular layers which surround the joint. Always a more or less active local inflammation takes place in the skin and the tissues underneath; it spreads sometimes deeply, as far as the ligaments, the synovial, the bones, when the contending agent has acted with great force.

During the days that follow, the region swells, becomes painful, the motions of the joints are very painful, and the lameness is intense, if the articulation belongs to one of the extremities.

For slight bruises, cooling applications (douches, astringents, compresses) or resolutives (camphorated alcohol) and rest are sufficient: the inflammatory symptoms soon subside. When the contusions are more severe, specially if the swelling is great, cold is good first. Later, warm baths, compressions, massage constitute the means of choice. For the superior joints of extremities, blisters are often used to insure immobilization of the joint. In some cases, the inflammation remains acute and the synovial membrane secretes with abundance; the treatment must be that of *closed arthritis*.

II.

SPRAINS.

This is a kind of incomplete and temporary luxation. Under the action of an excessive movement of flexion, extension, abduction or adduction, the articular surfaces are displaced and their means of union stretched; but that only while the duration of the action of the cause lasts.

The alterations produced are most variable as far as their severity goes; in mild cases, there has been only distension of the articular ligaments or rupture of some fibres; quite often they as well as the synovial are partly torn; it may happen that powerful funicular cords tear off with them the portion of bone upon which they are

attached; the tendons, the muscles, are also partly or totally ruptured or displaced; or there are cases where the diathrodial cartilages are crushed on the opposite side to that where the ligaments have given way; and, lastly, there is always a more or less abundant infiltration of blood, either in the peri-articular connective tissue or in the synovial itself.

According to the seat of the principal lesions, sprains are divided into *anterior*, *posterior* or *lateral;* but after a few days, the inflammation having spread all round the point, the anatomical diagnosis is often impossible.

Generally, it is easy to distinguish a sprain from a dislocation or a fracture. However, for the shoulder and the hip, hesitation is permitted on account of the thickness of the muscular masses.

The therapeutics of sprains has had many changes during the various epochs. In old farriery irritants were freely used; on a sprained fetlock, Solleysel applied its "emmiellure" (honey preparation); in sprained loins, these were covered with a coat of cantharides and pitch, half melted. Against recent sprains, Lafosse recommended bleedings and specially camphorated alcohol in frictions or cold water; when there was large swelling, emollients first, resolutives afterwards, were recommended. In the days of the physiological doctrine, the inflammation was treated by general and local bleeding, cold poultices (flax seed), emollient applications. The useless populeum was used in daily frictions; grease and oils were not neglected. Soon, however, observation showed the powerless effects of such treatments. Lameness, said Delorme, remained always during six weeks, two months, and even longer. Blisters, charges were then resorted to. It is yet to-day the therapeutics used by many; blistering, it is said, displaces the articular inflammation, brings it to the skin, immobilizing the joint at the same time by the soreness of the swelling it produces.

A rational treatment must vary according to the time one is called to interfere. In the presence of a recent injury, one must try to reduce the inflammation and the swelling. It has been recommended to give the joints *artificial movements* (passive?), with the object of replacing in their normal situation the parts which may have been displaced; their usefulness is doubtful. *Immobilization* is much better. It is obtained by keeping the animal perfectly at rest, hobbling the front legs together, or applying an immovable bandage on the joint. (See *Sprains of the Fetlock.*) Compresses, dipped in ordinary or salt water, white lotion, camphorated alcohol, have their usefulness. To be efficacious, the cooling action must be continued, if possible, constant; by this way reaction will be avoided. The applications of ice, recommended by

Bourrel, are good; they require watching: kept on too long, they may bring on sloughs of the skin.

Of late years *massage* and *elastic compression* are recommended.

The excellent results obtained in man by massage are well known. Choregraphy, specially, has been of great service in the treatment of spavins. But few years elapse without its doing wonders for some celebrated dancer. Forgue and Reclus mention the case of the "star" of the ballet of the Opera, who sprained her leg; treated by massage, she was cured in two days.[1] In animals, the recovery by massage is not so rapid; until now it has been but little used on account of their restlessness, the thickness of the skin, the abundance of the hair. It is made as we stated in the chapter on "Inflammation": the hands smeared with vaseline or glycerine, apply, in the direction of the venous current, rubbings, slight at first, then more and more heavy as the soreness subsides. These manipulations are continued for five or ten minutes; the clots of blood are crushed, the œdema is spread or easily resolved; the swelling of the joint soon diminishes. The lower articulations of legs lend themselves well to those manipulations; but the shoulder or the thigh cannot be massaged so easily on account of the muscles that cover them. When the rubbing is to be made against the direction of the hair, moderate massage will be performed by the application of a sheet of parchment over the region.

Elastic pressure has also for effect to spread through the conjunctive tissues the exudated morbid products. With it is sometimes associated refrigeration: the diseased region is enveloped with oakum, an elastic roller put over it, and then continued irrigation is applied.

Chronic sprains must be treated by stimulating frictions, blisters, firing, setons, irritating injections. Spirits of turpentine, ammonia, ammoniacal liniment, are often used, specially with cattle. If the blister is not applied by the veterinarian, he must be careful in marking with scissors the surface which is to be blistered. To neglect this simple precaution, is to expose one's self to have the blister improperly applied, and on parts which do not need it. With lasting lesions (indurations, periostosis), firing in lines, superficial or fine points are resorted to.

With some sprains—those of the shoulder or the hip specially—*setons* count yet numerous advocates; their beneficial action is principally due to the immobilization they induce. Against muscular atrophies irritating injections are useful, spirits of turpentine, watery saturated solution of salt, alcoholic solution of veratrine.

In general, we treat sprains at the beginning by immovable bandages, pressure assisted with refrigeration, hot moisture or blisters. After

[1] *Forgue and Reclus:* Thérapeutique Chirurgicale, Vol. 1, p. 50.

ten or fifteen days we use douches or massage. If lameness is slow to disappear, if some induration remains, periostosis or hydarthrosis, we resort to firing.

Sprains of Legs.

I.—Sprain of the Scapulo-humeral—Effort of the Shoulders.

For most of the practitioners and veterinarians of the first third of this century, *sprains of the shoulder* (entrouvertures) represented the greatest number of lameness of the anterior leg. In the *Compte rendu des travaux de l'Ecole de Lyon* for the year 1841–42, Rey mentions about one hundred and fifteen lamenesses of the shoulder; but in this number certainly were included lameness due to lesions of other parts of the fore leg. Since the difficulty of the diagnosis of some recent osteitis is better known, specially since the frequency of the lesions of the navicular apparatus has been demonstrated, the number of sprains of the shoulder has considerably diminished. At the Alfort clinics, where cases of lameness are so abundant, we only see rare examples of it. How many old lamenesses with emaciation of the leg, and sometimes accompanied with a motion of abduction, accused of being located in the shoulder, have been relieved by neurotomy, proving they were not situated in the shoulder.

Let us remember that Lafosse had justly insisted upon the rare presence of sprain of the shoulder and the frequency of foot lameness: "Many stories have been made upon sprains . . . often it is said that the horse has a sprain, while the trouble is in the foot or on the lower articulations of the leg . . . For one horse lame in the shoulder, there are hundreds lame in the foot."[1]

However, the existence of those sprains is not doubtful in horses and cattle. Necroscopical lesions have demonstrated their lesions. Varying much in their nature and seriousness, they may involve the joint or the tissues surrounding. Muscles and tendons, playing the part of ligaments, which partly rupture under the influence of the traction they receive, are the most common. The researches of Gaullet have proved the existence of the lesions of the pectoral muscles and of those of the internal face of the scapula. Peuch found in the sterno-trochineus and sterno-aponeuroticus tears with clots of blood on the road to regression. Rigot has often seen the partial rupture of the sub-scapularis. With the periarticular lesions, sometimes those of acute or chronic forms of arthritis also exist (Rigot and Renault). Sprain then is not characterized by univocal lesions: the lameness may be due to alterations of the

[1] Lafosse—Cours d' Hippiatrigue 1772 p. 248.

various organs of the scapulo-humeral region. If the leg has been carried greatly in abduction, the sub-scapularis, sterno-trochineus and sterno-aponeuroticus have been stretched and more or less torn; while excessive adduction, flexion and extension produce respectively alterations in the abductors, the extensors, or the flexors. In the "disease of Williams" observed in horses used for plowing and which travel with one lateral biped higher than the other, there are lesions of some given muscles, of their tendons, of the articulation and sometimes of the nerves of the shoulder.

To-day, as in the past, "knowing ones" always see in the shoulder the principal seat of lameness of the anterior leg; but careful examination of the foot and of the lower regions of the leg generally permits the discovery of the true cause of the trouble. Many authors, Bouley particularly for the horse, Cruzel for cattle, have insisted on that point. Lameness of the shoulder is more marked on soft than on hard ground; the step is short, the leg carried forward with great difficulty and close to the ground. By palpation, there is ordinarily a soreness of the shoulder-joint detected; one must always be guarded of the continual reactions of some animals. If the leg is raised by the hand and carried forward or backward, there is manifestation of pain; the animal groans, is on the point of falling, but is unable to free himself; the painful muscles of the shoulder contract little or not at all. The same manipulation practised on the other leg, by a sudden reaction the animal will free himself without trouble.

Recent lesions, accompanied with pain and swelling, demand immobilization of the joint and antiphlogistics. Immovable dressings being difficult to apply in that region, hobbling of the forelegs is often resorted to. Advocated in 1650 by Beaugrand, then by Solleysel, Garsault, Bourgelat, this method was proscribed by Vitet, and specially by Lafosse, and then abandoned. Renovated by Delorme, it consists in applying hobbles on the pasterns, the common or the forearm, and securing them together. To obtain a more complete immobility of the lame joint, the animal may be tied to both sides of his stall by ropes. From time to time, the hobbles must be looked after, to avoid sores they might produce: it is rare when they are required more than a month. This method has given very good results to most of those who have used it; applied from the start, it ordinarily answers for the most severe sprains. It is, however, indicated to employ cool applications, specially continued irrigation, astringents or irritating frictions. There are numerous preparations to select from: Delorme used camphorated alcohol or tincture of cantharides; others prefer the charge of Lebas, simple blister, mercurial or bi-iodine of mercury ointment.

Such are the treatments to apply against recent sprains. But numerous patients are brought to us that are lame for some time, and when already the joint has received several applications of those liquid preparations which are so common to-day. Against those old lamenesses, numerous treatments are advocated. Setons, rowels, are yet to-day in great repute; two, three, four are applied on the surface of the shoulder. The "monster" seton of Gaullet is not much used now; it had no special efficacy, and was more dangerous than the other. If setons are applied, one should be placed in front of the shoulder, the other on the external face; they should be about 20 centimeters long. The soreness that they produce helps in immobilizing the joint, they act also as derivatives and promote the resorption of exudated products (Bouley).

Lines, deep pointed, subcutaneous cauterization, are the choice means against old sprains. Potential caustics (sulphate of copper, arsenic, sublimate) used as trochiscus, have been recommended by some practitioners. Rey introduced under the skin, 2 gramms of sublimate corrosive and left them for 24 hours. "Fifty-three horses were submitted to this treatment, 35 for shoulder and 18 for hip lameness; all were cured, except three, two of which were lame for a very long time; in the third the true nature of the affection was not positively located"[1] Statistics of this nature are not to be depended upon.

Against "chronic sprains," subcutaneous injections of veratrine (1 gramm. in 5 gramms of water) have been recommended; they give rise to a local irritation which stimulates the muscular regeneration (Gerlach, Lübke, Möller). Injections of ether and spirits of turpentine are too irritating. Cruzel and Pages have used in cattle, subcutaneous injections of a concentrated solution of common salt: 25 cubic centimetres in five injections envelopng the shoulder-joint.

Let us now mention the means whose object is to produce in the injured structures forced movements which may stimulate organic changes. Old practitioners made the animal swim morning and evening for a quarter of an hour: they even obliged him to walk on the lame leg, by taking the sound leg off the weight of the body, either in placing a thick cork shoe on that foot or by raising the leg altogether and tying it to the forearm.

The treatment of Luchow was more complicated. The shoulder was first rubbed with the following mixture:

Liquor ammonia Spir. of turpentin.	32 gramms
Camphor. alcoh. Tinct. of soap	48 gramms

[1] Rey—compte rendu des travaux de l'Ecole de Lyon. Rec. Med. Vet. 1841.

then the animal, covered with double blanket and the neck well wrapped up, was exercised in circle, the lame leg outside, until the skin was covered with perspiration. Taken to the stable, thick compresses, wet with cold water, and changed every two hours, were laid on the shoulder; the last compress was placed in the evening and left on until the next morning, when it was taken off with the blankets. The next day the subject was walked for half an hour. Sometimes recovery was complete after two or three weeks. Hertwig and Delwart have tried this treatment with success. Nevertheless it is used but little. Cauterization, setons, irritating subcutaneous injections, completed by massage and a moderate exercise, are the classic treatments of old sprains of the shoulder.

II.—Sprains of the Knee.

This is rare; yet falls, slips, efforts, may produce it. Lameness, swelling, sensibility on pressure are sufficient for a diagnosis. Treatment is the same as in sprain of the fetlock. At first continued irrigation, plaster all round the joint, will relieve the inflammation; after two weeks, massage and promenade exercise. Chronic sprain shall be treated by lines or pointed firing.

III.—Sprains of the Coxo-Femoral—Allonge.

For a long time all obscure lamenesses of the hind leg were considered as located in the hip joint; but clinical observations and anatomical researches have shown the frequency of the lesions of the hock and the rarity of those of the hip. Examples of dry arthritis and of hydarthrosis of this joint have been related; but the true coxo-femoral sprain is one of the rarest affections. How many times has the error been made of locating a lameness in the hip which was later on manifested by the appearance of a large spavin! The axiom of Bouley is always true: "Out of one hundred cases of lameness of the hind leg, there are certainly ninety which come from the hock." And in doubtful cases, when all deformity or increase of sensibility are wanting, when the diagnosis is uncertain, the surest way is to watch closely the hock and the foot.

Although exceptional, sprain of the hip joint exists. Its therapeutics does not differ from that of shoulder injuries. Immobilization with hobbles is good; placed on the pasterns or the cannon, they keep the leg from being carried forward and outward; they help recovery very much (Delorme). The animal will not be allowed to lie down, by being tied up to the rack or placed in slings. After two or three weeks short walks will be given. Irritants may be associated with immobilization;

frictions are made on the thigh with camphorated alcohol, warm vinegar, spirits of turpentine, ammonia, etc., and renewed until the skin is getting covered with little scabs. The charge of Lebas, various liniments, mercurial blisters, have a more powerful effect.

Tape seton has been used, applied vertically on a level with the joint, with a length of 40 centimeters; some practitioners applied two or three, arranged in parallels. Rowell seton is a round piece of leather, which is introduced under the skin over the diseased joint. Trochiscus (sulphate of copper, arsenic, sublimate) have been recommended; the introduction of 2 gramms of sublimate under the skin is highly spoken of. Arsenious acid gives a much larger slough than the sublimate. In our days lines and deep pointed firing are principally used. Subcutaneous cauterization seems to have a more powerful action (de Nanzio, Lanzillotti-Buonsanti). The treatment of Luchow has been applied to sprains of the hip.

The subcutaneous injections of spirits of turpentine, or saturated solution of common salt, recommended by some, are inferior to firing.

IV.—Sprains of the Stifle.

Sprains of the stifle and lacerations of the patellar ligaments are the sequelæ of either an external violence or of a powerful and sudden muscular contraction or of an excessive motion. The simple distention and partial rupture of these ligaments receive the treatment of ordinary sprains. On a horse treated by Möller, the external ligament had been ruptured by the shaft of a wagon; on another the same accident occurred in the stable at the time the animal got up. In both cases the lameness was very severe, the lame leg scarcely resting on the ground. The stifle region was very painful. Recovery was obtained in a month. The treatment consists principally in rest and blisters. In bovines, the ointment of bichromate of potassæ is recommended.

Voigtländer has seen a cow in which the three patellar ligaments were ruptured. The treatment of such lesions is not undertaken in large animals. For those of small species, the joint should be immobilized by immovable dressing.

V.—Sprain of the Hock.

This is quite common. Although the tibio-astragalian ginglymus permits only motion of flexion and extension, under the influence of violent efforts, a slip or a jump, the lateral or the posterior ligaments of the tibio-tarsal articulation may be distended, strained, and sometimes the surfaces of insertion are subsequently inflamed. Often the tarsal sprain

is the starting-point of spavin, jarde, or curb. This indicates that the prognosis varies according to the seat of the lesions; but, in a general way, it is serious.

At the onset, the treatment consists in rest, massage and douches, revulsive or blistering frictions. Later, if the trouble resists, cauterization is indicated. The treatment of rebel tarsal sprain is the same as that of spavin, jarde or curb.

VI.—Sprain of the Fetlock.

This is one of the most frequent sprains. The metacarpo or metatarso-phalangeal joint belongs to the class of the ginglymus, permitting only flexion and extension; when it is flexed, it is scarcely possible to move it sideways. Any power able to give to that joint exaggerated movements of extension or flexion or likely to produce in it displacements incompatible with its structure, may produce a sprain. According to the localization of the lesions, sprains are divided into *anterior*, *posterior*, *lateral external* and *lateral internal*.

The *anterior* takes place ordinarily when the weight of the body is thrown on the joint flexed (as occurs frequently when the foot slips backward). On examining the leg, either raised or resting, a more or less marked sensibility of the anterior face of the fetlock and of the superior part of the pastern is detected, with also a slight swelling of those regions. The *posterior* sprain, due to violent and repeated efforts of locomotion, is characterized by alterations of the ligaments—tendinous apparatus of the posterior face. The *lateral* sprains have for principal causes mis-steps, slidings inwards or outwards.

Wherever is the seat of the lesions, the local phenomena, especially the pain and tumefaction, indicate the trouble. Numerous and varied treatments have been proposed against it. Solleysel surrounded the joint, for two or three days, with compresses moistened with solution of sulphate of zinc; he preceded those with some frictions of alcohol or turpentine, and then applied his "emmiellure" (honey paste) with oakum and rollers. Other practitioners employed blisters. During the first part of this century, local bleedings, leeches, emollient poultices, populeum ointment, camphorated oil, and those of opium, belladonna, the friction with camphorated alcohol, white lotion, etc., were recommended. If these means have answered in many cases, they are powerless against sprains of some severity. Continued irrigation may give good results; to-day it is often used at the beginning of the disease. Compresses round the fetlock, frequently sprinkled with cold water, are excellent for mild cases.

Delorme has recommended a method which consists in immobilizing the joint with an immovable dressing. Having mixed the white of ten eggs with thirty or sixty gramms of burnt alum, he impregnates three pads of oakum with it, and lays those all round the fetlock. A long roller is then applied over this, covered with the same sticking mixture, and rolled with a moderate pressure sufficient to obtain the immobilization of the joint. After a few hours, the bandage is dry; the joint, in good position, is reduced to most complete rest. Generally, after a week, recovery is obtained. In some thirty cases, Delorme was obliged to renew his dressing only in two heavy and lymphatic subjects; even with them recovery occurred in two weeks. In a very serious case treated by Kopp, white lotion irrigations were made first and during the night ice round the joint. The fourth day, a bandage applied (150 gramms of alum and white of six eggs); a week after, the horse had a free gait, and was very little lame in trotting. Many practitioners could record the good results they have obtained with this treatment or others similar. When the bandage is removed after a week or ten days, often the pain has subsided, the swelling almost gone; the joint has recovered its normal functions. And whether this bandage is applied immediately after the injury or some little time after, the results are excellent in most cases. Delorme relates the case of a mare which had been laid up for three weeks, the fetlock and tendon swollen, the rest of the foot very painful, the joint constantly flexed. He applied this dressing; eight days after, all lameness had ceased; it was taken off and another placed instead, which remained six days more, after which the horse resumed work. In the presence of very severe inflammatory symptoms, a slightly compressive bandage will be applied and constant irrigation followed for a few days. According to the author, "the powerful repercussion" produced by the alum, the contention of the diseased joint, contribute equally to the success of the treatment. But it is certain that it is specially due to the close immobilization of the joint and the compression. A plastered apparatus would give the same results.

Blisters and liniments have at all times been recommended. They will act as revulsive, "and with such rapid effect in most cases, that the removal of the inflammatory exudate seems to take place as if the bloody fluid accumulated in the capillaries of the inflamed synovial had been drawn towards the skin and fixed in its network."[1] By the inflammation and the pain that they give rise to, they realize, like bandages, immobilization of the joint; it is in this way that they are efficacious.

Whether coolings, blistering applications or immobilization have been

[1] *Bouley:* Dict. of Med. and Chir. Vet., Vol. V., p. 358.

used, it is good after ten or twelve days to resort to massage, with the hands smeared with a greasy substance; rubbing over the region from upwards downwards, or, better, from downwards upwards, will scatter over a wide surface the products exuded in the cellular tissue. Then the joint diminishes in size, the projections of the joint become more distinct, locomotion is less stiff. Morning and evening massage from five to ten minutes will be given, and the articulation enveloped with oakum, and a roller moderately tight.

At times some induration of the fetlock remains; the synovial remains dropsical or exostosis may develop on the altered epiphysis. In such cases line, fire, or needle-point cauterization is indicated.

Knuckling is a frequent complication of old sprains of the fetlock. In a three-year-old colt treated by Lardit, "the distension of the articular ligaments and of the extensor tendons was such, that at the moment the anterior foreleg, the one affected, came to stand, the anterior part of the fetlock touched the ground." [1] At the toe of the shoe of this horse was added a band, having the direction of the phalanges and which at its superior end was widened, padded and adapted to the forepart of the fetlock. Already, on the first day, the animal was able to walk, even trot; he resumed work a little after. The orthosome of Brogniez might be used.

Old sprains of the fetlock are generally complicated with periostosis. Median or sciatic neurotomy must be resorted to, to remove or diminish the lameness they produce.

In bovines, the therapeutics of sprained fetlock differs little from what we have said already. Recovery is rapid in most cases (Furlanetto). After cold lotions for twelve or fifteen hours, Cruzel uses blistering frictions.

Peuch recommends round the fetlock, three frictions, one day apart, with the following:

		Grams.
Spir. of turpentine, Campor. alcohol,	āā	30
Liq. ammonia, Tinct. canthārid, " of soap,	āā	20

Immobilization by bandage, massage, deserve attention also. Under the name of Big-foot (*pied-gros*) Festal has described a chronic sprain of the fetlock of bovines. The abnormal growth of the internal nail, pushing the fetlock outwards, produces, through the intermediate of

[1] *Lardit*: Journ. de Med. Vet. Theo. and Pract., 1833, p. 380.

the external ligament, sprains on the bones, which result ultimately in periostosis of the fetlock, localized first on the outside, but gradually spreading to the anterior region. The animal does not stand plumb any more, and the resting is made most exclusively on the outside of the external nail.

Such serious lesions are incurable, and render the animal unfit for any work, but when treated early, they may be avoided. Festal says: The internal nail must be pared, a thick shoe should be placed on the outside toe, and at the same time friction, somewhat irritating, made over the coronary band to stimulate the growth of the hoof. Blisters and firing have been used against the periostitis, almost always without success.

VII.—Phalangeal Sprains.

According to Percivall, these lesions are much more frequent than those of the fetlock. 61 cases counted by him show five of the metacarpo-phalangeal joint, 40 of the first phalangeal articulation, 16 of the foot. Some ten years ago, Vatel insisted on the frequency of the sprain of the first phalangeal joint.

Many of these digital sprains give rise to symptoms which are not much marked; at times there is local hyperthermia, and motion is painful. Manipulations of the blacksmith in removing the shoe increase the lameness; this is an important fact, says Vatel.

Once the diagnosis is made, the first indication of treatment is rest, the animal loose in the field or a box stall. At the onset, cold baths or continued irrigations of the foot are to be recommended. Later, damp and warm compresses, blisterings. Immobilization with plastered or Delorme bandages gives also good results.

If lameness continues, if specially the periostitis, which has taken place on the articular borders, promotes osteophytes and threatens ankylosis, firing must be resorted to. Too often, cauterization fails and high and double neurotomy has to be performed, or again the median or the sciatic. With very large periostosis of the fetlock and pasterns, these last operations will ordinarily produce sufficient improvement to permit work.

The sprain of the re-enforcing sheath of the perforans and that of the posterior ligaments of the articulation of the coronet, are recognized from ordinary phalangeal sprains by the situation of the local phenomena (swelling and pain) to which they give rise, and which are located on the posterior and lateral regions of the pastern and of the coronet. When once diagnosed, it is recommended to shorten the toe of the foot, save the heels and apply a thick heeled shoe or one with high caulks. At

the beginning of the disease, cooling applications are used (cold baths, astringent compresses, continued irrigation); later, wet compresses or firing. In case of failure, neurotomy. (See *Knuckling*.)

The digital region in working steers is frequently the seat of sprains; ordinarily it is limited to one toe. It affects the articulations of the pastern with the coronœ, and of this one with the os pedis. During walking, the animal carries the leg in abduction if the lesion exists on the external toe, and in adduction if it is the internal which is diseased (Furlanetto). Cooling and immobilization at first, later blistering and firing, are the indications. Satisfactory results are rare.

The inferior interdigital ligament, which in didactyles prevents the excessive separation of the toes, may be the seat of forced distensions. The animal must be left at rest, the toes bound together with bandages, and cold baths given for several days. Recovery is ordinarily rapid.

III.

LUXATIONS.

This term must be kept for the abnormal and permanent displacement of articular extremities. According to the degree of displacement luxations are *complete* when the articular surfaces have no longer any relation of contiguity and *incomplete* when the osseous extremities are still in relation to a certain extent. They are also divided into *traumatic*, those that occur suddenly on a sound joint; *consecutive*, *symptomatic* or *pathological*, those following an alteration pre-existing in the joint (dropsy, arthritis, tumors); *congenital* luxations are those which occur during fœtal life. These two last varieties are without importance for the practitioner; they demand the killing of the animal. Alone, *traumatic luxations* are interesting from the therapeutical point of view. Due to direct or indirect cause, they occur under the influence of traumatisms, slips, falls, or even by muscular contraction.

Such displacements do not take place without lesions, which sometimes are extensive; the synovial is torn; ligaments partly ruptured; muscles stretched or torn; cartilages bruised or crushed; frequently a fragment of bone is torn away by a ligament or a tendon; in some cases there is true fracture; blood-vessels and peri-articular nerves are injured or torn. The communication of the synovial with the exterior and traumatic arthritis are probable complications.

Three indications are predominant in the treatment of luxation: 1st, reduce it; 2d, prevent its return; 3d, attend the complications.

The treatment varies as to whether the luxation is recent or old. When it is treated before the appearance of the inflammatory phenomena, mild interference may sometimes succeed. The articular head has left its cavity in perforating the synovial; "through the opening it came out, it must re-enter." After having recognized the direction of the deviation, some few manipulations may be sufficient to replace the separated surfaces in their normal position. If the manner in which the luxation has taken place is known with some certainty, the first step of the reduction consists in bringing the leg back to the position it occupied at the moment of the luxation. By methodical manipulations, special to each displacement, the head of a bone can be reintegrated in its cavity, and thus a complete return of the relations of the articular surfaces can be obtained, while the means of force often increase the lesions, produce a new tear in the synovial, or only have for result to push it back into the joint and squeeze it between the articular surfaces; reduction is incomplete, return of the trouble almost certain. But if mild method, with or without narcosis, has failed, forcible process becomes obligatory.

In small animals, the operator may perform the *extension, counter extension* and *coaptation* alone. When operating on horses or cattle, assistants are necessary. It would be better to operate standing, so as to avoid violent efforts in getting up; but it is generally necessary to cast the patient. To make counter-extension, ropes fixed on the upper region of the leg (round the axilla in the fore extremity, round the groin for the hind leg) are pulled upon by assistants, or tied to rings on the floor or posts. The cords used for extensions are fixed round the pastern or above the knee or the hock. The force necessary to overcome muscular contraction is sometimes enormous. To overcome it, the method of the *continued pulling* is recommended. Soon the muscles become relaxed and the reduction is possible. If this means fails, anæsthesia, which "leaves the peri-articular muscles without resistance," is to be resorted to.

Pathological anatomy has revealed the changes which occur in a luxation which has not been reduced. The old articulation disappears, the articular cavity is filled with fibrous tissue; a true nearthrosis is formed round the displaced bony extremity, the surrounding tissues swell, adapt themselves to form pseudo-synovial and tendinous bands. A natural recovery takes place, but besides the fact that it goes on slowly, there always remains a lameness much marked. The two steers mentioned by Cadiot were still very lame thirteen months after a coxo-femoral luxation left to itself. In the reduction of old luxations mild means do not succeed; much force is to be used.

To reduce an old luxation of the humerus in man, Mayor had to employ twenty-one assistants! Compare the strength of the muscles of man to that of the powerful masses surrounding the shoulder or the hip of our large species. Assistants are rarely pulling at the same time, the tractions are jerky; for these reasons blocks and pulleys, which work steadily and regularly, had better be used. At first, the pulling is done in the present direction of the displaced bone, bringing it by degrees, as the leg is elongated, to its normal direction. During this step, the operator tries to obtain the coaptation; and, as soon as the bones are on a level, he pushes them against each other, in the axis they ought to occupy normally; ordinarily at that moment a special snap is heard, due to the meeting of the two articular extremities. The movements become possible, the joint resumes its normal aspect, the leg its natural length. The sudden change in the function of the extremity is striking.

In studying special luxations we will see that each of them has special manipulations for its reduction. Those are sometimes very hard and long; but by varying the direction of the tractions, in watching closely the coaptation, ordinarily the parts can be returned in their good position. Some cases occur when the attempts fail, and subcutaneous section of the fibrous strictures, or *antiseptic arthrotomy* has to be resorted to. Avoiding the blood vessels and the important nerves, the skin is divided, as well as the connective tissue, muscles, synovial; the alterations are examined *de visu;* the effused fluids are made to escape, the ligaments, which prevent the articular coaptation, are divided. This operation, which gives good results in man, has been partly successful in our hands on a dog suffering with an old luxation of the elbow.

The reduction obtained, return of the luxation must be prevented. The means to employ differ little from those indicated for fractures. Wherever possible, immovable bandages form the method of choice; they must always be resorted to on the extremities. In large animals, luxations of shoulder and of the hip are always difficult to hold reduced. With the first the iron splints of Bourgelat and the sticking mixture of Delwart are most recommended. Movements and decubitus are to be avoided; hence the necessity to keep the patient in slings for some time.

How long must the bandages stay in place? Some authors advise to remove them after a few days; others say not before six weeks or two months. Early movements predispose to return of the trouble, and to arthritis; too long immobilization may bring on ankylosis and amyotrophy. Not to count with the causes of failures, the bandage should be removed after two or three weeks, and the patient be allowed walk-

ing exercise. Stimulating frictions, massage, exercise, shall prevent muscular atrophy and render the movements regular.

Wounds constitute always a serious complication. Deep wounds which involve the traumatic center, ordinarily bring on arthritis and ankylosis; however, these are not fatal. As for the superficial lesions, antisepsy permits their cicatrization without infectious accidents.

Luxations complicated with fracture are, economically speaking, incurable in our large animals. In small species, the luxation should be reduced, and the fracture immobilized after its reduction.

Luxation of Extremities.

I.—Shoulder Joint.

Protected by thick muscular layers, the scapulo-humeral articulation is rarely affected with luxation. It is complete or incomplete. Hurtsel, D'Arboval, Mathorez, Roloff, Hertwig, Seyler have reported cases in horses; Matheron, Lodezzano, Bossetto and Seyler in cattle; many have seen it in dogs. It is sometimes accompanied with fracture of the glenoid cavity (Rigot, Lavocat, Lafosse). In reading the published observations, one is convinced that the humeral head is generally luxated forward; though luxations backwards, inwards and outwards are also observed. If it is sometimes difficult to detect the precise direction of the displacement, the symptoms are enough characterized to differentiate the luxation from a fracture, the only accident for which it may be mistaken. Sometimes, the animal has fallen forward, on the side, or when the leg was greatly in abduction; at others, in a race, the leg has violently struck against an obstacle (Hertwig, Smith). The horse of the Observation I. of Seyler was mounted; he stumbled and fell. When up, it was found that "there was no movement at the scapulo-humeral joint, the head of the humerus was protruding forward, and between it and the glenoid cavity there was a wide depression." [1]

All authors consider this luxation an excessively serious lesion, on account of the difficulty of reduction and contention.

Let us see how reduction must be made. According to Kaiser, nothing is easier with bovines. He says: Fix a rope at the fold of the pastern, carry the leg forward and upward until it can be secured to the horn of the same side and make the animal run. During this exercise, the reduction takes place. Then make an irritating friction on the point of the shoulder. Bossetto recommends the following method:

[1] *Seyler:* Annales de Med. Vet., 1856, p. 564.

Cast the animal on the sound side, pass a rope at the pastern, and pull on the leg; the operator with one hand holds this one steady, while with the other, it feels the relation of the articular surfaces. As soon as they can slip over each other, a strong pressure is made upon the humerus.

The method of Seyler seems to us better. To pull the leg forward, backward, outward or inward, according to the displacement of the humerus; then by methodical pressures made, push the head of the bone back in its cavity; those are the requirements. In one case of luxation forward, "I had the head of the horse held by a man, another carried the leg forward, while a third pressed hard on the knee, the humerus being held in its normal position by a fourth; I then gave a strong push to the head of the humerus with the palm of the right hand, and at once heard the very distinct snap of the bone re-entering its cavity." This method, which the author has used three times, has given him three successes.

If, in operating this way, one does not succeed, it is necessary to cast the animal. But reduction standing is to be preferred, as there is always danger of disturbances by the efforts made in getting up. For this reason, Peuch advises to throw the animal with the belly-band of the sling, which afterwards helps to raise him. In the horse, muscular power is overcome by the use of chloroform.

Most ordinarily, a peculiar noise indicates that the coaptation has taken place; if it is not heard, the conformation of the joint, and the length of the leg, which have become normal, tell the surgeon the result obtained.

The reduction made, next comes the contention. The iron splint of Bourgelat, "to fix the shoulders of a horse suffering with sprain," can be tried. (See *Fracture of the Scapula.*)

Mathorez, after reducing the luxation in a horse, applied a blistering friction. Matheron, treating a calf, applied on the shoulder an iron sheet padded with oakum and secured with the surcingle. In the three cases he treated, Lodezzano applied a pitch plaster. We have seen that Kaiser made on the region only simple irritating friction; Bossetto placed on the point of the shoulder oakum dipped in vinegar water, which he kept in place by rollers. Seyler used the bandage of Delwart. (See *Fractures.*) He states that, as soon as the operation is ended, the horse, subject of his first observation, "held back in its ordinary position the leg which he had lost the use of, as if nothing had ever happened." In the case of Smith, immediately after the reduction, the horse walked easily, and was scarcely lame, eight days after. If the horse has to be thrown, he must be raised with a great deal of care. In all cases it is

indicated to keep him for some time in slings to avoid the displacement of the bandage. This generally drops off after some twenty days. There is no inconvenience in allowing the horse to take a little exercise; relapse is not to be feared, and the best way to avoid ankylosis and amyotrophy is to make the joint work. Generally in a month or six weeks recovery is complete; in few cases does it take longer. Möller advises destroying, after ten or fifteen days, if there is no improvement.

With small animals, recovery is generally easy. The reduction once operated, a pitched bandage is applied like that recommended by Delwart for fractures of the scapula and of the humerus.

II.—Humero-Radio-Cubital Joint.

Notwithstanding its powerful ligaments, luxation of this articulation can take place. A violent kick on the external face of the elbow may produce the lateral deviation of the articular surfaces (Peuch). A similar accident may follow a fall, when the leg is carried in abduction, in adduction, or if caught under a wheel (Lafosse, Soumille). The mule of Lapouse,[1] loaded with three hectoliters of wheat, slipped and fell. On a first examination, the author remarked that the whole lower part of the left leg, from the elbow down, had a direction perpendicular to the median line of the body. "The superior extremity of the forearm was thrown inwards and beyond the condyle of the humerus; the lower extremity of this bone was resting on the external face of the superior extremity of the forearm and of the point of the olecranon." The horse treated by Decroix had a fall on the left side, the left leg bent under the shoulder, between it and the ground. When the animal was up, it was observed that the forearm was oblique, forward and outward, while from the fetlock, the foot had a vertical direction. It was easy, by exploration, to observe the overlapping of the surfaces of the bones; the articular head of the radius projected outwards and that of the humerus inwards.

Lafosse and Soumille have published observations of luxations of the elbow in dogs. On the collie dog treated by Lafosse, the humeral trochlea was projecting outwards and the articular surface of the radius inwards. The subject cured by Soumille presented, at the external and superior face of the forearm, a large swelling formed by the extremity of the radius; and on the internal face, a wound exposing the inner condyle of the humerus.

The deformity of the articulation and the immobility of the surface

[1] *Lapouse*: Journal des Veter. du Midi, 1842, p. 180.

clearly demonstrate the accident. In small animals, the reduction is generally easy with recent luxation. In the dog of Lafosse, after a few seconds of traction, a snap was heard, and the reduction obtained, the dog arose, and ran with only slight lameness. No bandage was applied. In a case of luxation with articular wound, Soumille obtained the reduction as easily, but the accident returned as soon as the animal moved its leg; a contentive bandage had to be applied. Seven days later, the dog used its leg; the bandage was removed; the articulation was normal, no swelling nor deformity; the wound, much contracted, did not allow the escape of synovia.

If luxation is old, reduction is sometimes very difficult. We had to treat, in a pointer, a luxation of the elbow, mistaken for a fracture and immobilized for two months. Notwithstanding anesthesia and the help of several assistants, it was impossible to reduce it. Arthrotomy had to be performed from the internal face. The synovial open, a great quantity of reddish synovia escaped; after partial section of the internal lateral ligament, the radio-cubital articular surface, which had deviated outwards, resumed its normal position. The recovery from the operation was rapid, and the therapeutic result satisfactory.

In large animals, though quite difficult, the manipulations are sometimes less hard than they were expected to be. Lapouse had the head of his mule held firmly, while two assistants supported the animal on the right side. Placed back of the dislocated leg, he flexed the radius to carry the olecranon backwards, then applied his right knee on the internal face of this bone while pushing the lower extremity of the forearm inwards and the inferior end of the humerus towards the thorax; a snap was heard, the leg resumed its direction; the animal could walk immediately. A friction of ammoniacal liniment was made on the articulation. Nine days after, locomotion was normal, and the horse resumed his work.

Decroix cast a horse and etherized him. Tractions made at the foot to bring the bones end to end failing (there was 6 centimeters shortening), the cannon was flexed, then two ropes placed, one on the lower extremity of the humerus pulled upwards, the other on the superior part of the radius and drawn downwards, were given to assistants. In a few minutes, the luxation was reduced. The joint was covered with melted pitch and oakum cut in small pieces. Twenty days later, the horse went to work.

To resume: in small animals, the reduction done early is easy, and the contention, during a few days, with bandaging, is enough to prevent relapse. In large animals, where the humero-radial joints demand great traction, anesthesia is a great help. To flex the forearm on the

arm, perform extension and counter-extension, practice opposite pressures on the osseous displaced surfaces, such are the requirements to fulfil; once the reduction obtained, a pitch bandage or the mixture of Delwart should be applied. To prevent displacements and the decubitus, the animal should be slung. After ten days there is no danger of relapse.

III.—Knee Joint.

Luxations of the knee are rare. Ordinarily complicated with fractures, tearing of ligaments and of tendons, recovery can scarcely be expected. The treatment must not be undertaken except for very valuable animals. In the *American Veterinary Review*, Flynn has reported the case of an entire two years colt, which was found one morning stretched on the floor, cast with his halter, the right foreleg flexed and much swollen on the knee. On manipulating the leg, he could feel "the carpal bones dislocated outwards, near up to the head of the external small metacarpal"; the lower surfaces of the trapezium and trapezoid could be readily felt. By pressures made on the lateral faces of the joint, the reduction was obtained. A contentive bandage was applied. A few days after, the patient was placed in slings and treated by continued irrigation. Recovery took place without complication.

IV.—Articulation of the Pelvis.

The *ileo-sacral luxation*, very rare, is unilateral or bilateral. Walking is always painful; there are at the croup abnormal movements, analogous to those of the sprains of the loins (Barreau). In general, the animal has great difficulty to get up; paraplegia may be suspected. This accident brings on a deformity of the croup and a permanent lameness. After a difficult labor, the cow spoken of by Mollereau presented a great drooping of the sacrum in the pelvis: "the summit of the croup and the anterior borders of the ilium projected 10 centimeters above the body of the lumbar vertebræ." According to Weber, similar accidents are not rare in difficult labor and produce paraplegia.

Solipeds should be placed in slings, bovines left at liberty. Repeated blistering frictions should be made on the croup, or a pitch contentive bandage applied.[1]

[1] W. Dimond has recorded a case which occurred at the Hospital of the American Veterinary College, of a horse which had been treated for sprain of the muscles of the loins and recovered, when a few days later he exhibited symptoms of paraplegia, lameness of the near hind leg, lancinating pains, and later on manifestation of meningitis. The animal was destroyed. At the post-mortem there was found extensive bloody infiltration of the sublumbar region, a fracture of the last lumbar vertebræ, with laceration of the saro-iliac ligaments with diseased condition of the articular surfaces.—*Am. Vet. Review*, Vol. 9, p. 127.

The *luxation of the pubic symphysis*, still rarer than the preceding, has been observed only in bovines. In solipeds, where the ischio-pubic symphysis ossifies rapidly, a parasymphysar fracture occurs rather than the separation of the pubis and of the ischiums. Guy has related the case of a five-year-old mare which, annoyed by flies, slipped on the pavement, both hind legs in abduction. At post-mortem, with a comminuted fracture of the bones of the pelvis, there was an ischio-pubic luxation. At the autopsy of a cow made by Golis, the ischio-pubic luxation coexisted with an ileo-sacral dislocation. This animal, like the heifer observed by Prietsch, which had a simple luxation of the symphysis, was unable to get up or to stand up.

The treatment consists in placing the animals in a quiet place, on a thick bed, and the lumbo-sacral region covered with a plaster of black pitch. Recovery takes place in two to four weeks; but there often remains a deformity of the croup and a weakness of the hindquarters.

V.—Coxo-Femoral Joint.

For a long time, according to classical authors, the luxation of the hip-joint without fracture at the head of the femur was considered as impossible. Rigot (1832) did not admit that the round ligament could be ruptured or stretched to permit the head of the femur to come out of the cotyloid cavity. For him "the force of resistance of this ligament was superior to that of cohesion of the femoral head: to such extent that efforts made upon the articulation were to fracture the bones rather than to have the ligaments give way and permit the luxation to take place."[1] In relation to this accident, Dietrichs says: "Luxation of the coxo-femoral joint cannot take place in a horse except after rupture of the round ligament, accompanied with excessive stretching of the capsular ligament. And, unless by circumstances unknown to this day, a fracture of the head of the femur or a part of the coxal occurs rather than the rupture of the round ligament."[2] However, in 1840, Rigot in his *Traité d'Anatomie* acknowledged his error.

Falke has related several cases of this luxation. In cadavers, he succeeded in producing it with a weight of 8 quintals in one case, of 16 in another. Each time he saw the head of the femur and the cotyloid cavity intact, while the round and the capsular ligaments were torn. At the autopsy of a mule killed because of a luxation Gourdon found the head of the femur intact, entirely out of its cavity; the ligament ruptured on a level with its attachment at the bottom of the cotyloid cavity, remaining adherent to the femur in all its length. At the

[1] *Lafosse:* Journal des Veter. du Midi, 1852, p. 57.
[2] *Dietrichs:* Lehrbuch der Chirurgie.

Lyon clinic in 1854, one analogous observation was made in the horse; here the coxo and pubio femoral ligaments were torn at their insertion on the femur. In an aged mule, used for surgical purposes, which had fallen with both hind legs carried in great abduction, the post-mortem revealed a complete luxation of the right hip; both articular surfaces were intact, and the ligaments torn from the femoral head.

These facts establish beyond a doubt the possibility of a luxation of the hip without fracture of the articular surfaces. However, in many cases, the accident is complicated either with fracture or with epiphysar separation of the head of the femur—in young animals (Arloing). In the observation that Goubaux communicated to the Société centrale de Médecine Vétérinaire (1875), and which related to an old femoral luxation, the head of the femur was fractured, and nearly its two internal thirds had disappeared. The horse whose autopsy was made by Peteaux, presented a complete and longitudinal fracture of the neck of the femur; the internal half was held at the bottom of the cotyloid cavity by the coxo and pubio femoral ligaments almost intact. In the horse of Weber, a bony fragment from the head of the femur was loose, and one from the coxal was adherent to the superior extremity of the anterior straight muscle of the thigh.

As complication of luxation, one may also meet with fracture of the trochanter or of one of the pelvic bones. The surrounding muscles are more or less lacerated. In the mule, just spoken of, there was a complete laceration of the vastus internus, at its femoral insertion; and of the gemini of the pelvis near their middle, as well as laceration and partial ruptures of the psoas iliacus, internal and external obturator.

However serious the accident may be, the symptoms are immediately well marked; at rest, the standing takes place by the toe or the plantar surface; in walking, the leg, deviated outwards, is carried all in one piece, with an abduction movement. The trochanter forms sometimes a marked projection in external luxation; it partly disappears in internal. The length of the leg is diminished or increased, according as the head of the femur is displaced upwards or downwards. It is generally possible to differentiate luxation from violent bruises or fractures. If the injury is left to itself, the animal may die from exhaustion; however, most ordinarily, the femoral head makes for itself a new cavity, walking becomes possible, but there always remains great lameness. Callot has observed two steers in which it was yet well marked thirteen months after the accident. Lafosse has registered cases of perfect recovery. He has seen, after nine months, emaciated muscles resume their normal size; the direction and the action of the extremity were normal.

Reduction must be done with the animal cast and anæsthised. Counter-extension is made with a rope, embracing the groin and with its ends attached to a fixed point. One or two ropes, placed above the hock and held by assistants, serve for the extension. The block and pulley permit more regular and steady pulling than assistants. The operation is difficult, and not without danger. A cow treated by Gamgee sustained a fracture of the neck of the femur.

The manipulations vary according to the direction of the deviation. To this effect, one must recognize luxations in those that are forward, backwards, outward and inwards. Extension will be made in order to carry the leg in a direction favoring the return of the femoral head.

The following are the methods used by the various authors who have written on the subject.

In the case of Saussol and Ranson the luxation had taken place inwards. The horse was thrown on the opposite side, extension and counter-extension applied in the usual manner. Under the thigh a pail covered with straw was placed and pressure applied on the external and inferior part of the leg, so as to make a lever of the first kind. After a minute of traction, "presuming that the articular surfaces were in apposition, extension and counter-extension were suddenly stopped, a sudden movement of the leg took place from backwards upwards (in relation to the position of the animal from forward backward), accompanied by a noise analogous to that of two stones striking together. The luxation was reduced, and the animal able to execute the ordinary motions of that extremity."[1] In similar cases Lafosse advises to place a thick round object between both thighs and to push against the lower extremity of the dislocated leg. For a luxation outwards, the same author recommends to throw the animal on the lame leg, to place a block near the trochanter, and to act on the lower extremity of the leg. By this process "he has operated successfully on two horses, a cow and several dogs."

To reduce a luxation inwards of the left leg, Vautherin threw the mare on the right side. A rope fixed in the coronet and pulled upon by three men made the extension, the weight of the animal the counter-extension. "By carrying with force, the superior part of the leg from inwards outwards, the head of the femur could be brought in apposition with the cotyloid cavity, but a little back of it; then by a strong and sudden pressure of both knees made by an assistant upon the projecting trochanter, at a second attempt, the head of the femur re-entered its cavity, with the peculiar noise made by the striking of two articular surfaces."

[1] *Saussol and Ranson:* Rec. de Med. Vet., 1829, p. 223.

Möller acts as follows: For luxation forwards (iliaj luxations), once the leg is in extension, push the head of the femur from forward backwards; in luxations backwards (ischiatic luxations), carry the leg in abduction, then give it a quick, double motion of adduction and rotation outwards; for luxations inwards (pubic luxations), similar manipulations with a greater abduction; for luxations outwards (supra cotyloid luxations), carry the leg in extension and afterwards in adduction.

Bossetto casts bovines, places them on their back, and has the dislocated leg, free from the hobble, carried backwards; one hand rests upon the trochanter, and with the other the movements of the femur are regulated in order to make the head of the femur re-enter the cotyloid cavity.

The reduction of an old luxation is rendered more difficult on account of new-made adhesions. Peuch could not obtain it in a dog whose injury was a month old. Anæsthesia would allow the continuation of the attempts at reduction; but the adhesions become so strong that the traction will not let the articular head re-enter the cotyloid cavity already partly filled with bony neoformation. And in such case it is useless to perform open arthrotomy. It is better to leave well alone.

To prevent relapse, Saussol and Ranson applied over the diseased part a coat of mustard and vinegar; the animal was kept lying down; the next day he was carefully raised with the slings; recovery took place without trouble. With the same object, Vautherin applied a rowel, animated with blister; after a month the mare was plowing; the lameness disappeared entirely.

If no complications occur, the animal can resume work after a few weeks. In the case of Furlanetto, the patient was turned out in ten days.

VI.—Femoro-Tibial Joint.

Luxations of this articulation are very rare. Some cases are reported in bovines. In the observation of Stolze, the tibia was dislocated forward; the leg stiff and somewhat shortened. The luxation could be reduced, but returned almost as quick; the animal was slung. The fifth reduction and the application of a stiff blister brought on recovery.

The cow mentioned by Hullot was lame on three legs; the stifle joint was a little swollen. On its level "the tibia formed on the outside a ressault, the width of the finger." The reduction, easy to make, was indicated by a sudden snap, but at the slightest movement of the animal, the tibia would resume its abnormal position.

Although the luxation is curable, it is one which ought not to be treated.

VII.—Femoro-Patellar Articulation.

The very great majority of observations described under the name of *luxations of the patella* relates to the arrest of this bone upon the internal lips of the femoral trochlea, which acts there as a hook. However, it is not less established, by a certain number of facts, that the true luxation is met with. The special anatomical disposition of the stifle joint in bovines favors very much the appearance of this accident. The luxation takes place specially outwards, but it is possible inwards, notwithstanding the elevation of the internal border of the femoral trochlea. Whether the result of a traumatism, of a slip backwards, of a violent contraction of the biceps cruralis or of a relaxation of the ligaments and muscles, it is always a serious accident. If reduction is easy, contention is difficult.

Having "a luxation inward of the left side" to treat in a mare, Perarnaud had the leg flexed by an assistant; another steadied the stifle, while a third pushed the animal slightly to the right. The author, placed on the right side and resting his right hand on the lower end of the patella, succeeded easily in replacing the bone in position. Rest and a friction of ammoniacal liniment brought on recovery. In a similar circumstance, Hullot, by pulling on the patella, was able to replace it easily, but the accident returned immediately. The cow was destroyed.

In general, in cases of luxation of the patella, as in the pseudo-luxation, it is advised to place a rope in the coronet, to pass it over the withers, then carry it between the forelegs backwards and hold the leg in complete extension. By pressure over the stifle in contrary direction to the displacement, the reduction is easy. The animal is tied up high in his stall and a blister applied over the whole joint.

With congenital luxation Bénard recommends a special means of contention. Take a band of linen, 12 or 15 centimeters wide, and long enough to go around the stifle region four times; cut in its middle a window large enough to receive the patella; at 10 or 15 centimeters from the opening make a vertical slit. Apply the band in such a way that the patella be lodged in the central window; pass one of the ends of the band through the vertical slit; pull hard; bring both ends of the bandage forward, crossing each other above and below the patella, and secure them.

Kept in position for eight or ten days, the immovable bandage will prevent all relapse. (See *Pseudo-Luxation of the Patella.*)

VIII.—Luxation of the Fibula.

Intimately fixed to the tibia by numerous short and strong fasiculi, it is rare for the fibula to be violently separated from the tibia. There are, however, some cases known. Behnke has published the case of a mare, which, after a jump, became suddenly lame on one hind leg; this was stiff and the standing impossible. These conditions lasted, and a big swelling took place on the superior part of the leg. The animal, of little value, was killed. At the post-mortem the fibula was found loose from the tibia and imbedded in the muscles of the leg. The interosseous ligaments had been torn. It is probable that the fibula could become immobilized in its abnormal position and the locomotion returns normal; but recovery would take a long time.

IX.—Hock Joint.

Luxations of the hock are rare. Some observations are related in the horse by Louchard, Blavette, Rey, Gavard, Stockfleth, Haubner; in cattle by Havemann; in sheep, dogs and cats by Stockfleth. The anatomical character and the severity of the lesions vary. Sometimes there is luxation of the astragalus; at others the dislocation takes place below it, between the lower bones or between the cuneiforms and the metatarsal. The dislocation, ordinarily incomplete, is often accompanied with ligamentous and cutaneous lacerations, fractures or crushing of bones. Let us mention the observation of Rey: A horse, used to pull railroad cars, caught his left hind foot between a switch and a rail; he was thrown. Raised, he cannot stand on the disabled leg; the hock is seriously injured; there is crepitation; the animal is destroyed. At the post-mortem there was found a luxation of the hock between the two rows of the flat bones of the joints with laceration of the external and interosseous ligaments, a rupture of the cord of the flexor metatarsi, a fracture of the large cuneiform and external metatarsal. Gavard has related a case of tibio-tarsal luxation. In a collision between two tramways, a horse was thrown down. When raised, at rest, there were but little or no symptoms; but as soon as called to move the right posterior leg was not raised from the ground but dragged forward. By exploration, a hard projection, formed by the extremity of the tibia, was felt on the inside. The horse was destroyed. "The tibia, violently raised and pushed inwards by the blow, had left the external border of the trochlea of the astragalus and was resting by its external groove on the internal border of the astragalus, forming inside by its second groove the prominence found during life. The

external ligaments were irregularly torn from their insertion to the tibia. The capsule of the anterior face of the articulation was torn in its middle. There was no motion possible in the articulation."[1]

All varieties of luxation of the hock are very serious. Recovery, when it is obtained, is always imperfect. On this account most animals suffering with it are destroyed. Schrader has published a recovery of luxation of the metatarsus in a cow; Stockfleth, with a cat suffering with subastragalean luxation, had success in reducing it and immobilizing the leg with an india-rubber band. In small species treatment might be undertaken. By extension, counter-extension and manipulation applied in inverse direction upon the inferior extremity of the tibia and the superior of the metatarsus, the luxation might be reduced. A pitched or plastered bandage would insure immobilization.

X.—Fetlock Joint.

According to d'Arboval, metacarpo or metatarso-phalangeal luxations are frequent. With Peuch and Toussaint, we believe that they are rare. They occur in various circumstances, but their ordinary causes are those which, acting with less violence, give rise to sprain of the joint. Cases are related in solipeds and bovines.

The lesions are sometimes extensive, and death may follow rapidly (Aureggio). On a horse seen by Lecoq, the inferior extremity of the metacarpal, which had perforated the skin, was exposed for a length of 10 centimeters; the lateral ligaments were ruptured, the phalanges and the foot thrown backward and outward in such a manner that the foot was on a level with the lower end of the metacarpal. Same serious nature of the lesions on the patient of Romary: phalanges thrown backward of the metacarpal, which, having perforated the skin, came in contact with the foot. In the observation of Neumann the

[1] *Gavard:* Journal de Med. Veter. 1890, p. 410.

Wray has recorded the case of a mare, which in a runaway accident had a complete luxation of the tibia and astragalus on the left hind leg, so that the tibia and metatarsus formed a complete right angle. The mare was secured, the luxation reduced, strong hickory splints and bandages were applied and the animal placed in slings, where she was kept for nearly a month, after which she was discharged, apparently sound, with the exception of a slight swelling of the joint, which gradually disappeared.—Amer. Vet. Review, Vol. 7, p. 20.

Dr. Townsend has reported the case of a cow, which had also a luxation of the tibio-tarsal joint after a fall, in which the lower part of the leg was dislocated outwards and forwards. The luxation was reduced at once. The leg was bathed in warm water, and when the inflammation had subsided oil of turpentine was rubbed. The cow remained lame.—Amer. Vet. Review, Vol. 7, p. 75.

phalanges formed with the metacarpus an obtuse angle open outwards; on the internal face of the fetlock there was a vertical wound, 15 centimeters long, through which the lower extremity of the metacarpus protruded; the ligaments were torn. Peuch has related a similar case.

Luxation of the fetlock may occur spontaneously or without violent effort. Cagny has seen a double luxation of both hind legs which occurred in that way. It was that of a thoroughbred stallion, "Veston," which, a few days before the accident, presented marked alternate lameness of both hind legs. Rheumatism was suspected, and treated with morphine, salicylate of soda, sulphate of quinine. One morning the horse was found lying down, the left hind fetlock dislocated. He tried to get up when a bandage was about to be applied on that leg, when the same accident occurred on the other fetlock. At the post-mortem, the tendons of the flexors and extensors were found normal; the articular, synovial and lateral ligaments were lacerated. Another example of spontaneous luxation has been published by Magnin: the animal walked on the inferior extremity of his metatarsals. In cases of this kind, there is certainly inflammation or previous softening of those lateral ligaments. When the skin is torn, and the articular synovial open, and whether these lesions are due to violent efforts, falls, or occurred as in the cases of Cagny and of Magnin, in general, treatment must be given up.

Fortunately the alterations are not always so complicated: for examples, the cases of Granet, Barrier, Blaise, Smith, Wilhelm, Schellhase. With them, the skin was intact, the articular surfaces more or less displaced forwards, backwards, inwards or outwards. In the horse of Barrier, "the os suffraginis, instead of joining the metacarpal with an angle of about 145°, was thrown backward; the articular surfaces were no longer in apposition, that of the metacarpal was resting on the anterior face of the suffraginis; the lowered digital region formed almost a right angle with the cannon, and if, in those conditions, standing had been possible, it could not have taken place except by the posterior face of the phalanges and the heels."[1]

In the subject of Blaise, "the phalangeal region formed with the cannon an obtuse angle, whose opening corresponded to the external side of the leg; the posterior face had become internal; the foot, following the same rotatory motion, showed its plantar face; on the inner side of the leg, and on a level with the small metacarpal, the superior extremity of the suffraginis protruded under the skin."[2]

Whatever may be the direction of the deviation, if it is not too great,

[1] *Barrier:* Journal des Vétér. Milit., 1870, p. 155.
[2] *Blaise:* Ibid., 1873-74, p. 419.

and if the joint is not open, there are cases where recovery may be looked for. Sometimes the reduction is easy. Blaise, with the right hand, took hold of the middle of the suffraginis, and, with the left hand, of the inferior extremity of the cannon; he pulled strongly inwards upon the dislocated bones, felt a sudden jerk, and at the same time heard a snapping noise. The bones had resumed their respective position. Smith obtained the reduction as easily. Barrier threw his patient, placed two ropes on the cannon and one on the pastern; this last was pulled in the direction to be resumed by the phalanges. "The leg thus prepared, a slow, continued and strong pressure was made with one hand on the posterior face of the fetlock, while the other, acting more particularly on the pastern, brought about the relation of the articular surfaces, which was indicated by a marked snapping noise."

To prevent relapse, the patient should be placed in slings and the fetlock immobilized. Granet applied a contentive bandage of rollers and black pitch, mixed with spirit of lavender; twenty-one days after, the animal resumed his work. Smith put on a shoe with two lateral vertical rods, having the direction of the lower end of the leg from the hock down to the foot; to which, on a level with the fetlock, a concave metallic padded plate was attached. These metallic rods were held in place by straps. The treatment was completed by firing, and followed by recovery. The patient resumed work after a few months. During the first days, Barrier had recourse only to astringent cold lotions; later, he fired the region. Blaise applied successively on the fetlock a friction of tincture of cantharides and an application of blister; twenty-five days after the accident, the horse returned to his owner. Cagny has obtained good results with simple astringent applications. In the case of Wilhelm there was luxation inwards of one hind fetlock; the horse was slung, the luxation reduced and kept in place with a solid bandage. In one of the observations of Schellhase (luxation outwards) the phalangeal region was perpendicular to the cannon, and there was, on the inner face of the fetlock, a large wound, through which the finger entered the joint. Treatment was, nevertheless, undertaken and the animal cured.

Immovable bandages are to be preferred in most of cases. The iron splint of Bourgelat deserves mention. Made of a metallic band, one centimeter thick, two and a half wide, having the shape of the leg from the superior part of the cannon to the heels of the foot, it is fixed on the shoe and held in place by straps. Relier's apparatus may also be useful. (See *Fractures.*)

Let us mention here the case of Fourie, relating to a luxation outwards of the external *large sesamoid* (left anterior leg), manifested by an intermittent lameness which resisted all treatment.

In bovines, luxation of the fetlock is rare. Few observations only have been recorded. The three cases related by Strebel were heifers, aged from fifteen months to two years. Each time the injury consisted in an overlapping of the inside suffraginis on the metacarpal. The reduction was performed standing or with the animal down. In these three cases, perfect recovery followed the application of a contentive bandage.

XI.—Phalangeal Articulations.

Luxations of phalanges are exceptional. United by strong ligaments and consolidated in their relation by very powerful tendons, phalanges are very little exposed to extensive and permanent displacements. Only very rare examples are published, all of the greatest severity. The case of Johne relates to a luxation of the third phalanx; the lower extremity of the os coronæ overlapped the small sesamoid backwards, the articular ligaments and the perforans were lacerated.

If treatment is to be undertaken, reduction and immobilization are indicated, as for the other luxations. Bandages recommended for phalangeal fractures would be useful here.

XII.—Pseudo Luxation of the Patella.

Solipeds and bovines are subject to a special and typical lameness of the hind leg, due to the patella becoming, so to speak, hooked by the summit of the femoral pulley. If the animal is made to walk ahead, the affected leg cannot be carried forward, but remains extended, obliquely downwards and backwards; any flexion is impossible, and when the animal moves, the anterior face of the hoof drags on the ground. Most minute exploration of the leg reveals only a slight tension of the muscles and a slight deviation of the patella outwards. These symptoms, however, disappear as rapidly as they occur; it is not rare after a few minutes' walk, or even after a few seconds, to see the various joints of the leg flex upon each other, first spasmodically, as in stringhalt, and then normally. And ordinarily the return of the trouble takes place without apparent cause.

These symptoms have received various interpretations. Solleysel, Garsault, Lafosse, saw in them nothing but a "cramp"; for Vitet, it was a temporary spasm accompanied with pains. Pastureau explained them by the arrest of the internal femoro-patellar ligament over the corresponding lip of the femoral trochlea. The great majority of authors have described this accident under the name of "luxation of the patella." But this last is very rare, and cannot occur without the laceration of one of the little femoropatellar ligaments.

Already in 1852, Meyer attributed the cramp of solipeds and bovines to the displacement upwards of the patella; for him, this bone became fixed on the internal border of the femoral trochlea, where it was held by the internal and median tibio-patellar ligaments. It is the theory advocated by Bassi in Italy, Chuchu in France, and to-day admitted without discussion. The slight deviation of the patella is due, not to a luxation of that bone, but to the fact that the internal border of the trochlea being higher and thicker than the external, the patella is somewhat thrown outwards.

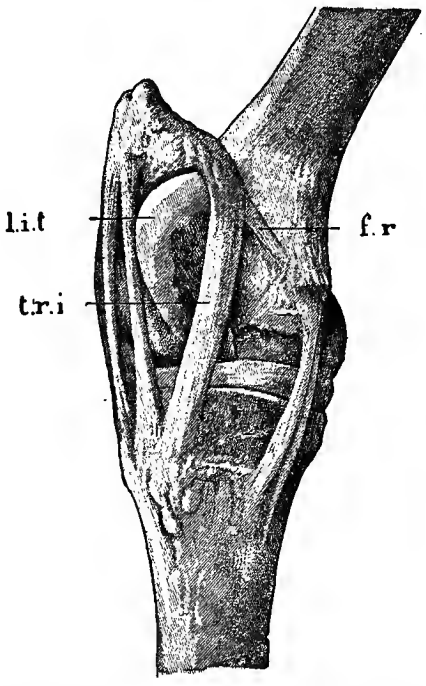


Fig. 112.—Stifle joint, l.i.t., internal border of the femoral trochlea; t.r.i., internal patellar ligament; f.r., internal femoro-patellar ligament.

But how can the patella assume that position and keep it? What power holds it there? Practice teaches that this accident is principally met with in colts, in animals recently put to work, in weak and anæmic subjects. It is thus that it manifests itself during the convalescence of some serious diseases (pneumonia, typhoid fever). A special conformation of the trochlea, specially of the kind of plate form which ends at its upper extremity; the disappearance of the fatty cushions situated under the tibio-patellar ligaments and above the trochlea, under the insertion of the triceps cruralis; the violent or incoordinated contractions of the muscles; the dry condition of the joint; all those are the causes of the accident.

The hooked condition is kept up by the stretching of the internal and middle tibio-patellar ligaments, of the first one principally. Violet has erroneously attributed it to a contraction of the patellar muscles.

Submit the young subjects to a methodical training, and give a repairing diet to those weakened by serious or long disease; such are the two principal prophylactic measures.

The accident exists; the patella must be returned to its place. A

first method is to make the animal walk, holding his head high to prevent its falling, and, if necessary, urge him with the whip. Most ordinarily after a few days the patella is unhooked and everything is in order. If walking fails, the animal must be made to back. If those do not succeed, apply a rope round the coronet, run it over the withers, have the leg carried in extension, and with the hand push the patella downwards and inwards. Some prefer to practice this while the animal is down and securing the lame leg in the position indicated for castration.

In general, the luxation is easily reduced; but, as we have said, relapses are frequent. Under the influence of methodical moderate work it returns only at intervals, sometimes further and further apart, and then disappears altogether. To hasten recovery, frequently repeated water douches can be prescribed, or blistering; friction on the stifle and nutritious diet, the bandage of Bernard, the apparatus of Weber, to hold the patella in place, are little used.

To overcome the "cramp of the vastus internus," Violet, after Trelut, advised the administration of one or two hundred gramms of cherry bark distilled water, diluted in honey and water. In rebel cases, to this antispasmodic treatment he associated blisters.

When the pseudo-patellar luxation does not yield to those treatments, it is indicated to divide the internal tibio-patellar ligament, as recommended by Bossi.

The modus operandi is simple. The animal thrown on the lame leg, the internal face of the stifle is exposed by carrying the opposite hind leg forwards, as in the operation of castration, or in fixing it on the corresponding fore leg, above the knee. The skin is shaved and aseptized. The straight tenotome, held in a very oblique direction, is implanted flatwise, back of the internal tibio-patellar ligament, immediately above the superior extremity of the tibia; withdrawing it, the curved tenotome is introduced under the ligament, and this is divided subcutaneously. The blood is wiped out and the wound closed with collodion.

The adipose cushion, situated under the tibio-patellar ligaments, protects the synovial from being injured with the instrument; by dividing the ligament very little above the superior extremity of the tibia, where this adipose tissue is abundant, one will readily avoid the synovial sac. The result is immediate. The wound heals in a few days.

This operation has given good results to Bassi, Falletti, Loy, Vachetta, Guigas. With this last author, it was successful in a very old

In the hospital records of the American Veterinary Hospital, Dr. J. Ryder reports the case of a stallion which was brought to the hospital for treatment of a luxation of the patella of several months standing. With great difficulty

case. We have performed it in an animal, on a case existing for a year. The success was complete. Our patient, "L'Orphelin," is to-day an excellent trotter.

Vandenmaegdenberg places bovines on an inclined plane, the hind-quarter 30 or 40 centimeters higher than the anterior; every hour cold water ablutions are made, and morning and evening frictions of camphorated alcohol with ammonia or spirits of turpentine.

The operation of Bassi gives also good results in bovines. Savio has had four successes out of four cases.

IV.

WOUNDS.

Among them we will consider:

1. *Superficial* or *peri-articular wounds.*
2. *Penetrating wounds*, or *with perforation of the synovial sac.*

I.—Peri-articular Wounds.

Frequent on the extremities, they offer, in their march and their prognosis, peculiarities due to the presence, in their neighborhood, of tendons, ligaments and tendinous bursæ—conditions which expose them to various complications. Fibrous tissues, poor in blood vessels, undergo necrosis easily if they are soaking in pus or invaded by an infectious process; the extension of the inflammation to the synovial is possible. With well-managed antisepsy, those accidents may be avoided. If the wound has been made with a soiled instrument, it must be cleaned in all its parts with a strong antiseptic solution (sublimate 2 p. 1000, cresyl 5 p. 100, chloride of zinc 6–8 p. 100, alcoholic phenicated solution: alcohol 10 grammes, phenic acid 1 gramme); then apply a

the luxation was reduced first, but, as soon as pressure over the patella was removed, the trouble would return. Warm fomentations and blister seemed to do some good at first, but after a few days the deformity returned and the horse was unable to use his leg. The case assuming a bad aspect, and the condition of the stallion getting worse, Dr. Liautard decided to try subcutaneous division of the anterior part of the biceps femoris, long vastus. At first this proved a failure. One morning the horse was lying down, when, suddenly frightened, he made a jump, and from that moment moved with perfect action. The recovery was perfect. The author asks if it is an error to suppose that the division of the muscle at the time of the operation was imperfect, but was completed when the animal made a sudden jump after his fright? In which case the propriety of such treatment in similar cases is indicated.—Amer. Vet. Rev., Vol. 8, p. 446.

wadded dressing. It is important to have an immobilization of the joint as complete as possible. Every one knows how difficult it is sometimes to obtain the regular cicatrization of wounds situated at the fold of the hock or that of the knee. Absolute rest, enveloping of the leg from the foot to above the lesion with wadding, dressing with splints, slings, are very advantageous means.

Large cicatrices on a level with an articulation interfere with their movements, hence the indication to reduce to the minimum the size of wounds which may leave such blemishes, by sutures and properly applied dressings.

Cicatricial indurations, so frequent in front of the knee, stiffen the leg, render the footing less solid and predispose to new falls. The therapeutics of broken knees in horses must benefit by modern discoveries. Instead of the vulgar healers, careful disinfection and antiseptic dressings must be used.

II.—Penetrating Wounds.

Penetrating wounds of joints and *traumatic arthritis* shall be considered separately. Not only is the opening of an articular synovial not necessarily followed by its inflammation, but, thanks to antisepsy, it can be avoided if interference is applied in time and properly. Serous membranes, like all other tissues, repair quickly in the center of wounds, providing they are protected from infection. The excessive severity of articular wounds is indeed not due to the lesion of the aponeurosis and tendons (Paré), nor to the resistance of the tissues to the inflammatory swelling (Brasdor, Bichat, Larrey), nor to the action of the exudate upon the synovial and the cartilages (David); it depends entirely on the inoculation of the wound, the infection of the synovial. Every day we see in horses, as well as other animals, the punctures of synovials, made aseptically with fine trocars, cicatrize rapidly by first intention. Here again, without contamination, no complication; without germs, no suppuration.

Sometimes the infection of the synovial is primitive, and results from the direct introduction of the injuring agent in the interior of the articular cavity; at others, it is secondary, consecutive to the suppuration or necrotic inflammation of the para-articular tissues. In this last case, the prognosis is most serious, as, ordinarily, when synovia escapes outside, the serous is already deeply altered.

At the onset, the symptoms are little accused; a wide or a narrow wound, allowing the escape of synovia, exists on one of the faces of the joint, locomotion remains regular, work can be kept up. But the in-

flammation is not slow in spreading through the joint; this swells, becomes very painful, the synovia which escapes is cloudy. Oftener, if the trauma is not attended to properly, after a lapse of time varying between two and six days, the practitioner has a traumatic arthritis to treat.

That which must be prevented, is the inflammation of the synovial. We will see how this prophylaxy demands early aseptization of the wound, followed with immobilization of the joint as complete as it can be obtained.

The severity of traumatic lesions of articulations is, in general, in proportion to the functional importance of those organs. However, the dimensions of the wound, its location on the anterior, posterior or lateral face of the joint, the extent of the peri- and intra-articular lesions, have much influence upon this severity.

The researches of Rigot and of Goubaux have shown that articular, like tendinous, synovial sheaths are at times divided by partitions in several lodges, a fact which explains the localization of the infectious process to one part of the synovial, and the rapid recovery of some articular wounds and some recent arthritis.

It has been said that articular lesions of the hind legs were ordinarily more serious than those of the anterior; but the real differences observed on this point are more due to the anatomical complexity as well as to the more or less active function of the joints. A deep wound which involves a thick layer of peri-articular tissues is ordinarily more serious than the simple wound of a cul-de-sac. A wounding body which opens a joint, making in the tissues that cover it a wound oblique downwards and inwards, gives rise to a more compromising injury, more exposed to intra-articular complications, than if it runs through the tissues in an inverse direction. We cannot insist too much on this point: what creates the danger, is the infection; those are all the conditions likely to produce it or favor it.

In the presence of an articulation which has just been opened, is it proper, by probing, to explore the wound to precise the diagnosis or recognize the exact condition of the alterations? To-day, in human surgery, says Ch. Nélaton, "the exploration with an aseptic probe, or, better, with the finger, after enlarging the wound, is absolutely indicated." For our patients, on account of the circumstances in which we are to realize asepsy, this practice would be dangerous. Although the synovial flow is not characteristic of the opening of the articulation—as it may result from a wound of the tendinous sheath—probing must be excluded. Nothing is more dangerous than to enter joints with dirty or suspicious probes, and explorations with an aseptic instrument which

passes along the walls of a wound, made accidentally, is not always harmless; the instrument may become infected in passing through the wound and inoculate the synovial. It is best to act as if the wound was of the most serious nature. How many times the curiosity of the practitioner has had for consequence the inflammation of a joint, which could, otherwise, have remained closed.

The therapeutics of articular wounds and of traumatic arthritis has varied much with all epochs. In pre-antiseptic times, the great severity of those wounds has suggested against them the trial of the whole medico-chirurgical arsenal. Most varying preparations have in turn been advocated and thrown aside.

Old farriers were already divided on the question of the treatment of wounds of joints. Some, with Solleysel, used cauterization; others, with Garsault, recommended emollients.

In the years that followed the publication of the first veterinary journals, the physiological doctrine was at its best. To prevent or overcome inflammation, abundant bleedings were resorted to, and the patient submitted to severe diets; the diseased joints were covered with decoctions of marshmallow, flax seed, or populeum; simple poultices, or those associated with narcotics, were used. The wounds themselves were dressed with tincture of aloes, diluted alcohol, camphorated paste. The advocates of the antiphlogistic method published their results, and Corroy, Auboyer, Prétot, made comments on the "lucky series."

For Lecoq, the inflammatory symptoms ought to be treated first by emollients, then the joint be immobilized and the wound dressed with a compressive bandage. He said: "I am inclined to consider the mechanism of the cicatrization of synovial membranes as analogous to that which closes blood-vessels when their coats have been divided; a portion of the blood coagulates in the opening, adheres to its borders, and in organizing, ends by becoming part of the divided coats. Compression, assisting the formation and the sojourn of the clot, must necessarily hasten the time of the cicatrization."[1] If antiphlogistic methods succeeded sometimes, the failures were numerous, and soon were used as objections to it (Renault, Tisserant); and again cases of spontaneous recoveries were recorded, in which nature had done all the work. Still, for a long time, poultices were kept in use. They reduce the pain, and were supposed to "prevent inflammation." We know to-day that their hot and moist atmosphere is, on the contrary, most favorable to pyogenous microbes and to infection.

As early as the beginning of this century, English veterinarians

[1] *Lecoq:* Rec. de Med. Vet., 1833, p. 416.

advocated cauterization of the external opening of the fistula, so as to produce a scab, preventing the flow of synovia, and assisting the cicatrization of the wound. This treatment was tried in France. Mercier and Desmoulières did not hesitate, when treating at the beginning of the disease or in full period of inflammation, to thrust into the fistula an iron heated white. The results seemed encouraging. The observations of Pauleau, Gérard, Pigeaire, Dubois, Faure, Eisele, had a tendency to show that deep and repeated cauterization could bring on recovery in cases where other treatments had failed. Renault called this method "rash and irrational"; he admitted it only in extreme cases. The use of the red iron upon articular wounds gave rise to a disinfecting action which, in some cases, might be beneficial; but it was rightly set aside for methods less incendiary.

Tisserant remarked that emollients and cauterization of the fistulas gave only incomplete results. "There remain swellings of the diseased joint, indurations of the skin or of soft parts, enlargements of the articular extremities, often even exostosis. Against these, alteratives, resolutives, actual cautery, etc., are used, and the treatment is prolonged beyond any expectation."[1] The author recommended to abate the inflammation by emollients, then to use blisters in repeated frictions round the joint. Instead of this last, pointed (Renault, Lecoq) or line cauterization could be used. Sometimes ten or fifteen days after the application of the blisters the animal could resume work. As derivatives, numerous preparations and agents have been proposed, from the most complicated topics to the simple sinapism. In a case of articular wound of the hock, Saussol, after a twisted suture, applied all over the joint "a coat of mustard diluted in vinegar; twenty days after the animal resumed his work." Some authors attached great importance to internal treatment. Tartar emetic was much recommended; Reboul advocated it as late as 1845.

So as to obtain the closing of the synovial wound, every substance, which, by virtue of its chemical properties, was able to coagulate albumen, was tried in turn. Burnt alum (Lecoq), alcohol and tincture of aloes, Rabel solution (Mercier), tannin (Caussé), salts of lead (Mazzino), and sulphate of copper have been used with more or less success; but it is no doubt sublimate corrosive that has the largest number of advocates. In a few years it supplanted all its rivals. Recommended by St. Cyr, then Dubois, Ollivier, Pierre, Dyer, Delorme, Romant, Payan, from the first days that it was used, it became acknowledged as one of the most efficacious drugs in the treatment of articular wounds. In a

1 *Tisserant:* Journ. des Veter. du Midi, 1845, p. 145.

superficial joint a pitched or turpentine pad was dusted over it, applied on the wound, where it was kept by bandages or adhesive strips. Sometimes the synovial flow would stop, and when the dressing was taken off, after eight days, "the bottom of the wound was covered with a firm scab and recovery insured." If the obliteration was not complete a new plaster was reapplied. With deep wounds the fistulous tract was generally enlarged, as Schaack and Delorme did, and a lint, covered with the caustic, introduced in the fistula. Several authors, in particular Rey, have added blisters to that treatment. They were applied round the whole surface of the joint, with application of the sublimate over the wound.

Barthe has tried to substitute nitrate of silver to sublimate. Bichloride of mercury sometimes acts too strongly and gives rise to slough of a large eschar, which increases the size of the wound, while nitrate of silver, less active, easier to handle, gives rise to a scab, rapidly eliminated, without increase in the size of the external wound. Its use is very simple. The pencil is introduced in the fistula, where it melts slowly. It is good with large wounds to move it about to insure its action upon every part of the penetrating wound. Its application can be renewed several times, and at the same time the application of a blister can be resorted to.

Collodion, simple or with sublimate, has been recommended, some twenty years ago, to obtain the closing of the wound. Michotte, having a deep wound of the stifle to treat, used first cool applications. The second day four grammes of sublimate were dissolved in thirty of collodion and applied in successive layers over the wound until formation of a stiff scab. Nine days after this was removed; the wound was closed. Degive has also used the sublimated collodion with great success.

Cold water has been recommended early, and is yet to-day used in large animals. Guilmot, Duvieusart, Sepulchre, Barreau, Sinoir, Caussé, Eloire and many others have published observations in relation to the happy results they have obtained. For Trasbot (Archives 1877), "cold irrigations constitute the treatment par excellence of articular wounds." The flow in sheath is better than the strong current or the irrigation. As much as possible, the water shall have a temperature of 12 to 15 degrees. However, irrigation must not be left off, only when the temperature of the water is in the neighborhood of zero. When irrigation was experimented with at Alfort, students were made to apply it, changing every hour, night and day, and constantly showering the diseased part with a tube attached to a bucket placed full of water above the patient (Bouley). In the case of Barreau "irrigation was done by six men, alternatively pouring water over the wound with a syringe."[1] Such methods had the

[1] *Barreau :* Journ. de Med. Vet. Milit., 1862, p. 18.

inconvenience to require too many assistants to apply it. They were not practicable.

Irrigating apparatus have simplified the method. A reservoir, placed at 2.50m. from the ground, is fed with a watering pipe; at its bottom a metallic cork is adjusted, provided with a rubber tube, of various lengths, and 7 to 8 millimeters in diameter. According to the cases, the free end of this tube is introduced in the wound, or its terminal extremity, perforated with holes made in its length, is twisted round the leg, above the diseased joint. The metallic cork may have two beaks and carry two tubes; one to go round the joint, the other in the cavity. An apparatus for irrigation can be arranged anywhere by using a tub, a barrel or a reservoir *ad hoc*. As with many practitioners, continued irrigation has given us remarkable results. We have seen an enormous articular wound of the left hind fetlock, made by a ploughshare, healed in a month. The wound and the synovial were irrigated with a tepid solution of cresyl, 3 p. 100; for a few hours the articulation was enveloped with antiseptic compresses, then submitted to a constant stream of cold water. In five weeks recovery was perfect. A mare treated by Mauri had a contused wound of the anterior face of the left fore fetlock, with open joint; after nine days the irrigation was stopped. "The synovial flow had stopped, the articular fistula was closed, and the wound entirely covered with firm and healthy granulations."

About 1860, Ægyptiacum ointment, recommended by Verrier,[1] became "the favorite drug." In the treatment of articular wounds, this author used first bleeding, diets, poultices, emollients, soothing lotions. The pain reduced, he enlarged the fistula so as to be able to introduce his finger into it, and with it several times a day he pushed in it a certain quantity of ointment, pure or diluted in oil. With this treatment, says Verrier, pains subside rapidly, standing improves, fistula contracts, synovial flow becomes less abundant. Often after eight or ten days the fistula is cicatrized and the joint has recovered the complete freedom of its movements. Benjamin, Robert, Fœlen, Royer, Salle, published good results obtained with it, and notwithstanding the failures of Raulet, Caussé, Barreau, Ægyptiacum is classified amongst the best remedies.

Glycerine, used alone or with blisters, and continued irrigation has been recommended by Aureggio. Injected in the fistula, "it shortens the period of congestion and the articular inflammation;" it has given a number of successes "in desperate cases."[2] But many practitioners have failed to find in it a superiority over the preceding methods.

Camphor, quite in use some time ago in the treatment of articular

1 *Verrier:* Bullet. de la Soc. Cent. de Med. Vet., 1858, p. 1042.
2 *Aureggio:* Bullet. de la Soc. Cent. de Med. Vet., 1878. p. 290.

wounds and then ignored, is yet employed in Belgium, in connection with antisepsy.

Here is the therapeutic technic used by Hebrant, which gave him 95 p. 100 of recoveries:

Immediately after the accident, the injured region, after being well cleansed, is soaked in bran water. It is then disinfected in the most complete manner with phenicated water 5 p. 100, or Van Swieten solution, and then covered with a coat of camphor ointment (camphor and lard a. a.).

"The horse is kept by himself, in a narrow stall, and submitted to a proper diet and nitrated drinks. The ointment is applied four or five times a day. After the first three days the strength of the ointment is reduced—1 part of camphor for 2 of lard, 1 for 3, 1 for 4. The horse is not taken out of the stable as long as the treatment lasts. The great quantity of camphor spread over the whole region produces a continuous coolness, which prevents the inflammation of the joint; the second or third day the region is swollen, the albumen of the synovia is coagulated, granulations are stimulated, the fistula is soon obliterated. Besides this, camphor has antiseptic properties, that we re-enforce by the addition of phenic acid in the proportion of 5 p. 100."

This, it seems to us, is an antiseptic method in which camphor does not play the principal part. To clean and disinfect the region with phenicated water at 5 p. 100, or with Van Swieten lotion, this is well; but iodoform in powder, or iodoformed vaseline, would give just as good results, at least, as camphorated ointment.

Among the treatments recommended of late, let us mention the envelopment of the region and the closing of the wound with a rubber roller (Petzold), with "clay" (Hoffmann), and the injection in the wound of an alcoholic tannic solution (Vigezzi).

By this examination of the history of the therapeutics of articular wounds, it is seen that recoveries have been obtained with most varied means. But if comparison could be made between the successes and the numerous failures, the result would be of the darkest. Whatever has been said, most of those treatments would be powerless against penetrating traumas, if infected in their depth.

The notions given by the pathogeny of the complications to which wounds are exposed impose the abandonment of the old methods for antisepsy. This must dominate the treatment of articular wounds.

Pricks of articulations, in general, are less severe than large wounds, or those with loss of substance. Made under given rules, they are harmless. We will see that hydarthrosis can be punctured with trocar with most complete impunity; but for that we used instruments

of small size, clean and aseptic. It has been advised to enlarge the wound, to open the synovial freely, to asepticize the articular cavity; such interference seems to us harsh in animals, where the purification of the joint is always very difficult. We are satisfied with the disinfection of the trauma and its occlusion with a dressing or a collodion covering. Let us mention the observation of Michotte, relating to a wound of the stifle joint, which was in this manner covered with several coats of collodion and healed in a few days. The application of a sublimated plaster, after disinfection of the prick, and a peri-articular blistering friction, form a treatment deserving keeping; the bichloride of mercury, deposited near the synovial wound, acts on it by its germicide action; the blister brings on immobilization. The success obtained by Rey, Dyer, Delorme, has shown the value of this process. The essential is not to enclose infectious elements. Before being "barred," the wound must be carefully disinfected. As remarked Tisserant already in 1845, if obliteration is efficacious, "it is with the condition that the synovia shall remain identical to itself; it is that the fluid, prevented from flowing by the clot, shall be, as the blood, normal and compatible with the regularity of the function; it is, at last, that no cause, external or internal, shall have modified the synovial secretion in its quality, so that the wound can be repaired regularly."[1]

To prevent the infection of the synovial, or to purify it in its soiled part and protect it afterwards from the germs: such is for *large wounds*; as for pricks, what must be realized? A careful antisepsy of the trauma, by a free irrigation, shall be made; by collodion covering and several bands of gauze, it will be protected, after being dusted with iodoform; then the region shall be immobilized in wrapping it with a wadded apparatus, with or without plastered rollers, or again by a blistering friction (blister, bi-iodide of mercury ointment, alcoholic solution of sublimate 1 to 10). When the region does not permit the application of a dressing, blisters are used, specially with advantage for narrow articular wounds. The "derivative" action attributed to them is fallacious, almost null in its "useful" effects; but it can have a most beneficial influence in producing immobilization and closing of the wound.

When the wound is very large, it can be reduced by a few stitches made towards its superior angle; for some joints, drain tubes must be applied. With our wounded animals, total suture is dangerous; if the asepsy of the superficial layers is not thorough, infected fluids spread to the synovial. It has succeeded, however, in many instances. Saussol has obtained a success by the twisted suture.

[1] *Tisserant:* Loco citate, p. 114.

One of us has related a case of rapid recovery by antisepsy, of a very serious wound of a hind fetlock. On the external face of this region, there existed a straight solution of continuity, 10 centimeters long; the metacarpo-phalangeal synovial was widely open between the large sesamoids and the inferior extremity of the principal metatarsal. In separating the borders of the wound, we could see in front the metatarsal and phalangeal articular surfaces, and behind the anterior one of the great sesamoids. The peri-traumatic surface and the wound were disinfected, irrigated with Van Swieten solution, and an iodoform wadded dressing applied. This was removed seven days after; under the gauze was found only a little reddish serosity; the synovial was closed and the tissues covered with granulations. A new dressing was applied. A month after, the wound was all healed. Treated with minute antisepsy, articular wounds would have no other march, if their purification could always be made perfect.

Sometimes the wound is complicated with fracture of the articular extremities. Small splinters would not necessarily produce the fatal loss of a joint; but there is always advantage to destroy the patient. Resections and amputations are not admissible in our therapeutics. The cow with wooden leg which illustrates the cover of the *Surgery* of Hoffmann will not tempt practitioners, and still less owners of animals. These operations shall be reserved for small animals. Conservative surgery is always to be preferred. By well directed antisepsy, dressings well applied, septic accidents shall be conquered. Ankylosis is always better than amputation, on account of the accidents this last is exposed to, and the great difficulty presented by orthopedy in veterinary surgery. The gazelle amputated by Laligant for a metatarso-phalangeal arthritis, which died from the operation, would have lived with an ankylosed leg, if frequent cleansing injections had only been used.

It remains for us to say a few words as to immobilization. Almost all authors have considered rest of the joint as a very favorable condition to the repair of the wound, and have advised it as much as it is possible. In 1873 Degive expressed doubts upon its efficacy. It was known that horses suffering with traumatic arthritis of the knee had perfectly recovered, although they were obliged to travel some distance (Servoles). In various cases, where immobilization had been neglected, recovery had taken place as rapidly as when the leg had been kept at rest. Degive asked himself, "if immobilization was really useful or preferable to free motion, to moderate mobility of the articular levers." For Maris, "immobilization is always useless in articular wounds, the animal fulfilling this indication himself." Laho and Thiernesse, on the contrary, continue to believe that this immobilization is one of the principal con-

ditions of success, and the great majority of authors are of the sar opinion.

To reduce inflammatory phenomena to their minimum, the patie should be placed in slings, unless he is too irritable. For lower artic lations of the legs, wadded dressing gives a sufficient immobilizatio for the others, blistering should be used.

Immobilization must not be kept too long; one must take into cc sideration the stiffness of the joint and the peri-articular amyotrophie As soon as the synovial wound is closed and pain is gone, massage ar moderate exercise are the therapeutics of convalescence.

As remarked by Tisserant, often recovery is not complete; the remain lesions which necessitate the application of firing. With a tisepsy, these consecutive alleviations are less frequent at present.

We have had particularly in view the treatment of articular wounds horses. For *cattle* and *small animals*, the indications are the same. dogs, tepid repeated antiseptic baths have given us the best results cases of wounds of articulations of the extremities.

V.

TRAUMATIC ARTHRITIS.

With soiled articular wounds in general, already the third, fourth fifth day, the infection has spread into the joint: traumatic arthri exists.

The swollen, very painful, articulation is held in the position mc favorable to the relief of its structure. If it be on a leg, the standi takes place on the toe; there are frequent convulsive movements of t leg indicating lancinating pains; a warm, œdematous swelling i vades the surrounding regions or the whole leg; there is an abunda flow of synovia scarcely of suspicious aspect or already purulent.

As the infection process spreads, the symptoms are more marke the most limited motions of the joint give rise to acute pains, that t animal avoids in remaining immobile, standing on its place or co stantly lying down. Soon the swelling has become enormous. Throu the fistula the escaping synovia is purulent, loaded with yellowish-whi clots, exhaling a fœtid odor. Fever is high, the temperature going up or above 40°. The loss of flesh is more and more marked; escha due to the long decubitus, appear on the prominent parts of the boc When the subjects resist, the articular cartilages are destroyed and t joint ankyloses. But this termination is not fatal; by an energe treatment started early, it can be avoided.

In the preceding chapter, we have indicated the various therapeutic means employed during this century to treat articular wounds and traumatic arthritis: bleeding, diet, emollients, dressings with tincure of aloes, camphorated preparations, alum. tannin, sulphate of copper, blisters, caustics, firing, continued irrigation, ægyptiacum, glycerine, cauterization of the fistula, lines or points cauterization. The greater part of these methods have been left aside.

Antiseptic injections and blistering applications or continued irrigation remain the practical treatments to oppose to traumatic arthritis at its beginning. During recent years, facts have multiplied which demonstrate the superiority of antisepsy, for traumatic arthritis as well as for recent articular wounds. When the wounded synovial is the seat of an infectious inflammation, injections and antiseptic irrigations are far superior to the methods or the agents of old therapeutics, not excepting caustics or ægyptiacum.

If already the infectious lesions are deep, if the synovial is much thickened and granulating, if the cartilages are on the road to destruction, all hopes to save the joint its normal mobility must be banished. Nevertheless, antiseptics will diminish the general disturbance, conjure infectious and putrid infections and assist ankylosis—relatively fortunate termination for certain categories of wounded (breeding or small animals.) They may do more, at the beginning of the articular phlogosis. The synovial alone is infected, sometimes only in a part of its extent, the synovia is but little modified in its properties, the cartilages are still with their normal polish; recovery is possible. If a little stiffness and swelling of the joint remain, massage, blisters, or cauterization should be resorted to.

One must not be afraid to enlarge a narrow wound, to permit injections and washings to be made more easily, more complete and active. Mauri, Labat and others have related facts which show beyond doubt the beneficial action of sublimate. In the first case of Mauri, it was a mare, which, in falling, had opened her right fore fetlock. Ten days after, notwithstanding astringents and camphorated preparations, "the animal grew worse and worse. She moves with difficulty, on three legs, in her box; she suffers a great deal from her lame leg. The swelling of the joint is hot, exceedingly painful; the edges of the wound are swollen; the synovial, reddish-yellow, escapes in abundance; it coagulates in large clots on the anterior face of the first phalanx and exhales a peculiar, characteristic fœtid odor. The swelling has spread to the lower part of the fetlock; lymphatic cords starting from the diseased region extend towards the superior parts of the leg." A blister was applied on the joint and injections of Van Swieten were made in the fistu-

lous tract. Seven days later, the synovial discharge had stopped, the fistula obliterated, the animal was gay. During a week, burnt alum was applied on the granulations to keep them under control. A few running water baths completed the recovery.[1]

Immobilization is important. By means varying according to cases (wadded dressing with or without plastered bandage, blisters, hobbles, slings) the movements of the joint must be limited as much as possible.

When arthritis runs its course, treatment is very long. Fistulas must be freely enlarged, abscesses punctured, irrigations abundant. Often the suppuration lasts for weeks, sometimes months, and numerous patients, exhausted by the pains, covered with bed-sores, succumb to the disease.

For the study of the traumatic lesions of joints individually, we have not separated the *penetrating wounds* from *arthrits*. It would seem, *a priori*, that in the three, four or five days following the opening of a synovial, this must be invaded by purulent phlegmasia, and quite numerous observations are found of rapid recovery in synovial wounds of eight, ten and fifteen days; on the other hand, the general phenomena and the lameness are not absolutely characteristic of arthritis. The grouping of the observations would have been difficult, even arbitrary, for many among them. To consider separately articular wounds, and in particular arthritis, would have been of no advantage in the practical point of view.

Articular Wounds and Traumatic Arthritis of Extremities.

I.—Scapulo-Humeral Joint.

Penetrating wounds of the scapulo-humeral joint are rare. For many observations, positive diagnosis was not made, the lesions of the bicepital groove not being distinguished from those of the joint itself. Rey has mentioned two cases where recovery was obtained with sublimate corrosive; one was published by Schaack, the other by Pierre. This last author introduced in the wound a tent covered with populeum and dusted it with sublimate; a second application two days after; six days later, the synovia escaped no longer; after six weeks the horse was cured. Romant, having a mule to treat which presented on the external face of the right shoulder-joint, a little back of the most prominent part of the angle of the shoulder, a deep transversal wound, with synovia escaping, covered the region with a blister, and applied a little sublimate every day on the wound. After three days, a thick scab was

[1] Mauri—Rev. Vet., 1889, p. 62.

formed, the synovia stopped running, the swelling and the lameness had disappeared. Fifteen days later, recovery was complete. With injections of perchloride of iron, Leblanc stopped a synovial discharge of the shoulder in eight days.

In our day, one must resort to antisepsy to prevent the infection of the joint. Called for a recent wound, the veterinarian should disinfect it with solution of sublimate, phenic acid or cresyl. If it is a prick, it will be closed with iodoformed or sublimated collodion. Large wounds should be reduced by stitches on their upper angle and covered with iodoform or a plaster of sublimate. If already the infection is produced, if the synovia runs purulent, by a free incision the joint must be opened and irrigations made with Van Swieten fluid. Most generally it is better to destroy the animal. As remarked by Mitaut, scapulo-humeral arthritis seems, indeed, to be one of the most severe of the extremities.

II.—Humero-Radio-Cubital Joint.

According to Percivall, penetrating wounds of the elbow must be classed among the most rebel. Rey says that they are those which have seemed to be most dangerous. Mitaut has never cured any. Still, some successes are recorded.

Mercier has related the case of a horse suffering with a deep wound of the external face of the joint; there existed a narrow fistula, with escape of synovia; the wound was cauterized with the red iron, so as to form a superficial eschar; recovery was obtained in two weeks. The patient of Pauleau presented alarming symptoms. After the prick of a fork in the elbow there occurred a large swelling, warm, very painful, and accompanied with high febrile reaction; a few days after a rough surface could be seen on the humerus and radius at the bottom of the wound. The diseased bony surfaces were cauterized and frequent injections of tincture of aloes were made in the joint; recovery took place after a long time. A few successes have been obtained by Tisserant with emollients and blisters; by Rey with the red iron, and Rabel water; by Delorme with sublimate. The first observation of Verrier relates to a penetrating wound of the elbow produced by a kick. The horse was very lame, a warm and painful swelling extending from the middle part of the arm to the elbow; fever was high; synovia escaped in clots through the wound. During twenty-one days, emollients, tincture of aloes and cauterization were successively employed, all in vain. In two weeks, with ægyptiacum introduced three times a day in the fistula, the synovial discharge was stopped and the lameness removed. Again with ægyptiacum, Salle obtained the recovery in a month, without blem-

ish or lameness, of an open elbow which had been treated for five weeks by blisterings and injections of all kinds.

Continued irrigation has given a recovery to Trasbot. It was a horse which presented at the upper part of the forearm an oval wound measuring from five to six centimeters in its transversal diameter. This wound, oblique backwards and inwards, was ten or twelve centimeters deep, reached to the external side of the elbow joint. During four days cleaning and antiputrid injections were made, but the swelling of the joint became enormous and the discharge of synovia abundant. Digital exploration discovered the rupture of the external lateral ligament. An S probe was easily introduced in the articulation. A counter-opening was made about twelve centimeters back of the external wound, a drain tube introduced into the new tract made and continued irrigation started. Ten days after the synovial discharge had stopped, the fever subsided and the lameness gone. Hydrotherapy does not always succeed as well: we had two occasions to use it and two failures to record.

When one is called to a recent penetrating wound of the elbow, and the local disorders do not impose the immediate condemnation of the patient, antisepsy is the treatment to choose. The wound and its surroundings shall be disinfected, and the clots of blood, the hair and foreign bodies removed; it will be irrigated freely with tepid Van Swieten fluid, and covered with collodion coating and a wide wadded dressing, held in place by rollers crossed over the withers and in the axilla. Instead of this dressing, an application of blisters can be resorted to.

If the wound is infected, there is but little chance of recovery. Wherever is the seat of the wound, injected fluids cannot penetrate deep enough, and disinfection of the joint is impossible. After free incision, it is again injections of tepid Van Swieten solution that must be used. When, after eight or ten days of treatment, the discharge of synovia is still purulent, the whole articulation is swollen and the general symptoms aggravated, the animal ought to be destroyed.

III.—Knee-Joint.

Traumatic lesions of carpal joints are almost always the result of falls on the anterior legs. In front and behind those joints, there are tendons provided with special synovial sheaths; the escape of synovia, in wound of the knee, is not then a positive sign of the opening of the articular synovial. Penetrating wounds of the anterior face of the knee are less dangerous than those of the posterior. According to Trasbot, this dif-

ference is due specially to the fact that the capsular ligament is more organized and apt to become vascular and granulate than ordinary fibrous tissue; it is also on account of the greater anatomical complexity of the posterior carpal region.

A great number of treatments have been used with success. In several cases of recent articular wounds antiphlogistic treatment has given good recoveries to Corroy and Auboyer. The animal treated by Corroy had fallen going down a hill, and after the accident had been obliged to travel, trotting or galloping, eight leagues. The synovial capsula was open in two places, the bones widely exposed. Recovery was obtained in eighteen days; the lameness disappeared entirely. With Pressecq, other practitioners added to that treatment the cauterization of the bones exposed. Coagulating agents and caustics have been recommended: Mercier has related two cases of recovery with Rabel water; Caussé twenty-two with tannin; Guilmot a few with starched bandage; Mazzini five with plastered dressings; Rey two with sublimate. Nitrate of silver has often succeeded with Barthe. Mitaut has recommended blistering applications on the diseased joint; Cagnat, slight and repeated cauterization of the wound with caustic tar.

Verrier has had several successes with ægyptiacum. His case of Observation IV was a fearfully broken knee; the wound involved the skin, the cellular tissue, tendons, capsular ligament and the anterior part of the carpal bones; there was high fever and great pain. After bleeding and emollient poultices, sprinkled with decoction of poppy heads, which gave no results, ægyptiacum was used: in ten days the recovery was certain. There remained but a superficial wound, and the lameness had disappeared. The same result was obtained with Observation V. The horse treated by Robert was in the worst condition, when ægyptiacum was resorted to: recovery was rapid. Royer and other military veterinarians have published similar results.

Although cold water in continued irrigation is a practical means, highly recommended, immobilization should be preferred to it under a wadded iodoform dressing. The wound ordinarily contains gravel, earth; the tissues are bruised and ragged: wash with boiled water, then a strong antiseptic solution, apply a coat of iodoform and a wadded dressing.

With padded splints or frames applied upon the lateral and posterior faces of the knee, it is easy to bind, in a great measure, the movements of the joint. Already Mercier had recommended immobilization. "Take five strong laths, cut them the length of the leg, apply four straps with buckles on one of their faces at even distances, wrap the laths with oakum and lay the apparatus round the injured region. With one of those bandages, the leg is kept constantly in extension and the joint in

immobility."[1] Three padded splints can be applied, extending from the middle of the forearm to that of the cannon, being held in place by dextrined rollers or straps with buckles. A blister upon the lateral face of the hock is also a simple and useful means of immobilization.

When suppurative inflammation has invaded the articular synovial, the "game must not be considered as lost," as Barreau did, although the prognosis is most serious. Instead of any of the treatments proposed, antisepsis and blisterings will be preferred. Subjects of little value should be destroyed.

Sometimes the knee remains large, wrinkled, and a lameness remains, varying in its severity: cauterization must be used or median neurotomy.

IV.—Femoro-Tibio-Patellar Joint.

Deep wounds of this articulation are common. According to Rey, they are the most frequent of all articular wounds observed among solipeds; they are also the least serious. Treated early, when the synovia is not yet purulent or the infection of the synovial is neither diffused or deep, they ordinarily close rapidly. Often a blister has been sufficient to obtain a recovery, as shown by the observations of Tisserant, Delorme and Rey. Out of twenty horses treated by Rey, eighteen were cured by blister and one by sublimate; only one died. And yet the symptoms seemed at times very serious. The mare of Observation II had received, eight days before, a kick on the external face of the thigh; a large swelling had formed, which had been punctured. When Rey saw the patient, the articulation was hot, painful, the swelling extended down to the hock, the synovial discharge was abundant. Two frictions of blisters were made, twenty-four hours apart; after nine days the mare was entirely cured. In the Observation III, it was a mare injured two weeks previously: a kick had opened the femoro-patellar joint. A blister having failed, a trochiscus of sublimate corrosive was introduced into the fistula; eight days later, it was obliterated. Superficial cauterization of the wound (Dubois), tannin (Caussé), have also obtained cures.

Many successes have been related by the use of continued cold water irrigation. Let us mention specially those of Sepulchre, Barreau, Eloire. The observation of this last author is that of a horse that had fallen in going down a stiff hill and had been dragged by the vehicle. The stifle presented a wound large enough to admit the fist. "It left exposed on the right the internal vastus, which has received the shock almost alone; on the left, the tendon of insertion of the long abductor of the leg, some

[1] *Mercier*, Rec. de Med. Vét., 1840, p. 461.

centimeters above the point where it is inserted upon the internal patellar ligament; at the bottom and between these muscles, some centimeters deep, the right articular surfaces of the corresponding condyle of the femur, as well as the anterior face of the right inter-articular meniscus, could be recognized, and then above and in front the patella.

"From the gaping wound, which widened transversely when the leg was flexed, abundant discharge of synovia escaped, spreading over the surface of the leg and there coagulating."[1] Submitted to irrigations of cold water, to which was added a weak proportion of sub-acetate of lead and phenic acid, the patient recovered rapidly.

It is to careful disinfection of the trauma that one must resort at first in all cases. A few stitches of suture and a drain are sometimes necessary. Wadded dressing being difficult to apply in that region, the wound should be closed with iodoformed collodion (Michotte), a plaster of sublimate or a strong blister. With large wounds, antiseptic injections are indicated.

V.—Hock Joint.

The extreme severe nature of deep wounds of the hock is due both to the anatomical complexity of the hock, and to the frequency and extent of its movements. Let us mention the few successes obtained by antiphlogistic treatment (Corroy, Auboyer), by cauterization of the fistulas (Desmoulières, Arnal, Feuvrier), with tannin (Caussé), camphorated paste (Delwart), starched bandage (Guilmot), Rabel water, Plasse's caustic (Marès) Rey with a deep wound of the internal face of the hock, made by a nail, applied as many as six cauterizations with sublimate; the horse recovered. Blisters, advised by Tisserant and Rey, have often been used in connection with the caustics introduced into the fistulas. In Saussol's case, the synovial was open, on the inside of the leg, with a wound one centimeter wide: the ragged edges were smoothed over with scissors, a twisted suture put on, and a coat of mustard and vinegar was applied on the whole internal face of the region. In twenty days, the animal resumed work. Duvieusart treated with cold water a deep wound of the hock, through which the finger could readily enter the joint, and which was already accompanied with febrile reaction and marked general symptoms. Recovery was complete in a month.

Ægyptiacum has been no less advantageous than with the other joints. In a serious wound of the hock, which had remained rebel to emollient and Rabel water, Verrier obtained recovery in ten days. In Observation I,

[1] *Eloire*, Archives Vétérin., 1878, p. 609.

of Salle, it was a mare that, from a kick on the antero-internal face of the hock, had the joint opened. Ten days of ægyptiacum treatment brought on recovery. Let us also mention the cures obtained by repeated injections of glycerine in the fistulas.

But with all these treatments, failures have been numerous. Antiseptic means ought to be preferred. Sublimate or nitrate of silver introduced in the fistula (Barthe, Ribaud) are not as good as injections of Van Swieten.

With extensive wounds, after disinfection, the edges must be brought together with few sutures.

If already inflammation has spread to the synovial, again antiseptic irritation must be preferred. When there are bony lesions, as in the case of Barreau, where the cuboid was fractured, no treatment ought to be undertaken.

VI.—Fetlock Joint.

This articulation is one of the most exposed to injuries. With emollients, Gellé has obtained the cicatrization of a deep wound of the fetlock produced with a prick of a fork. In the case of Corroy, emollients and tincture of aloes dressings also brought on recovery. Prétot treated with baths and dressings of tincture of aloes an articular wound of the fetlock, following too severe firing, and complicated with partial necrosis of the first phalanx; recovery was obtained in twenty-five days. With a deep wound of the metacarpo-phalangeal joint, Feuvrier used first emollients, afterwards lines firing all over the fetlock. In less than a month, the horse resumed work.

In one of the observations of Rey, there was a large wound on the anterior face of the fetlock with synovial discharge. The joint was very painful and the leg swollen up to the hock. Several blistering applications were followed by radical recovery. Sublimate has also given excellent results. In the Observation III of Rey, there was a deep wound of the right hind fetlock, with purulent synovial discharge; in eleven days he was cured with three successive applications of sublimate. Observation IV presented, on the left anterior fetlock, a bruised wound, 15 centimeters long and 10 wide, complicated with open joint; three applications of sublimate arrested the synovial flow. In the case of Knoll, it was a horse which had a wide deep wound of the left fore fetlock, the joint and the great sesamoid sheath were open. After trying emollients for fifteen days, sublimate was resorted to, and the wound healed in twenty days. Guilmot has advocated starched dressing. Observations II, III, IV and VIII of his report, relate to the fetlock joint. In the first, a two-year-colt had it opened with the rope of his

halter; the wound was wide, the articular surfaces could be felt with the finger; tight linen rollers coated with starch were applied from the pasterns to the knee; after a month, the horse worked. In Observation VIII it was a cow which had one of her metacarpo-phalangeal joints opened with a hook. The treatment was begun the fifteenth day. A splinter was first removed, a starched bandage applied; nineteen days after, the wound was all healed.

Continued irrigation has its part of success (Duvieusart, Arnal, Sinoir). In Sinoir's case, the deep wound existed for a week, the lameness was very great, and the fever high. In a few days, irrigation brought on the closing of the synovial wound. In the report of Verrier, recoveries by ægyptiacum are mentioned, which were obtained no less rapidly. Observation II was a peculiarly serious case. After enlarging of the wound and ægyptiacum injections made three times a day, recovery occurred in two weeks. Many other successes were obtained with the same agent. More recently, Aureggio has related cases of cures by injections or dressings of glycerine.

For arthritis of the fetlock, as for others, all those treatments must make room for antisepsy. A recent wound should be irrigated with tepid Van Swieten solution, then covered with an iodoformed wadded dressing. One of us has published the excellent results obtained with this method.

If already the articular infection exists, free incision of the wound should be followed by frequent injections in the joint. Mauri and his pupil Negre have recommended sublimate.

In the case of Mauri, a blister was applied upon the whole joint and frequent injections of Van Swieten made in the fistula. The third day, the discharge was already reduced; the seventh, it had stopped entirely; the animal walked in its box, resting on the whole plantar surface. With the patient treated by Negre, the same treatment was used (blister and Van Swieten injections every two hours); recovery took place rapidly.

VII.—Phalangeal Joint.

Although deep wounds of the *first phalangeal* joint are quite common, only rare observations are related. In that of Mercier, published in 1826, the joint was open transversely for about one centimeter and a half; there was no standing on the leg. Dressings of compound tincture of camphor brought on recovery in fifteen days. A horse treated by Verrier had a wound of the anterior face of the pastern; a flap of skin had been torn, the joint was open. "Bleeding, baths, poultices, then ægyptiacum, closed the wound in fourteen days." The

lameness lasted a long time, "on account of the hard swelling which surrounded the diseased region."

With recent wounds, disinfection and an antiseptic dressing constitute the choicest treatment. When there is arthritis, it is often complicated with tendinous, ligamentous or cartilaginous necrosis. After enlarging the wound, continued irrigation or antiseptics should be used.

Ankylosis is a termination, less unfavorable than to other joints, on account of the limited motions which the arthrodia performs; but it is often accompanied with voluminous periostitis, which, later on, imposes neurotomy.

The *articulation of the foot*, though protected by the superior border of the wall, is one of those where traumatic lesions are most frequently observed. In days gone by, when cartilaginous quittor was operated by the entire extirpation of the fibro cartilage, it frequently happened that the lateral cul-de-sac of the articular synovial was open. Already in 1828, Pauleau spoke of the relative benignity of those wounds of the joint of the foot. Vatel has several times opened it on purpose, without observing the slightest accident; the animals recovered quickly and as well as those in which the synovial was respected. However, the rule is not without exception. With well-made antisepsy, the opening of the articular synovial during the operation for quittor is still less dangerous than before. A thorough washing of the wound with the solution of Van Swieten and an iodoformed dressing prevent all complication. Considerably more serious is the prognosis, when the joint has been perforated with a dirty infected instrument or when its opening is due to the mortification of peri-articular tissues (cracks, quittor, complicated nails in the foot). Then, almost always, the joint is invaded by suppurative inflammation, ordinarily ending by ankylosis.

Our publications contain, however, examples of rapid recovery of those lesions, which seemed to imply a fatal termination. Pauleau (1829), in one case of articular fistula, situated in front of the coronet, used first "antiphlogistic means, then thinned out the hoof covering the diseased tissues, and made a camphorated dressing with pads dampened with tincture of aloes. Six days later the synovial discharge had stopped; shortly after, recovery was complete. Mercier has related two recoveries of pedal arthritis with Rabel water. In the first, the articulation was the seat of high inflammation, the febrile reaction was great, purulent synovial discharge took place from the fistula; a first dressing gave no result, the eleventh day Rabel water began to be used; in ten days healing was completed; the joint kept the freedom of all its motions. In the second case the horse had a nail in the foot, which, according to the author, involved positively (?) the phalangeal joint

between the third phalanx and the small sesamoid. Delafond obtained in two months the cure of an arthritis due to a nail in the foot. In the case related by Courdouan, the lesions were of extreme severity. "The weight of the hoof alone made the joint open two centimeters at least, and if we try to flex it laterally, it dilates so much that a stroke of bistouri at each commissure of the wound would separate entirely the hoof from the third phalanx; the little sesamoid is separated almost completely; it holds only by one of its extremities." Emollient baths and alcohol dressings brought on ankylosis in a month without great deformity. Delorme tells, without detail, that with a blister he obtained in twelve days the recovery of a very severe wound of the articulation of the two last phalanges. In Observation III. of Verrier, it was the case of a pedal arthritis which had occurred after the operation for nail in the foot. After vainly trying emollients, tincture of aloes, blisterings, injections in the fistulas, the author used ægyptiacum, introduced some of it as deep as possible with a probe; all the fistulas healed in fifteen days. In the case of Fœlen, the articular borders of the second and third phalanges could be felt with the finger, through a wound of the internal side of the foot. Every day a pad of oakum covered with ægyptiacum was applied on the wound; in three weeks recovery was complete. Saudé, after the operation for nail in the foot, with lesions of the navicular bone, had to treat an arthritis. The inferior wound was dressed with glycerine, alcohol was injected in the fistulas of the coronet; six weeks later, all lameness had disappeared, even in trotting. In a case of nail in the foot with fracture of the navicular bone, where Humbert removed the bone, three weeks after, recovery was certain. Sesamoidectomy has been unsuccessful with Möller and all those who have tried it.

Since the communication made before the Société Centrale de Médecine Vétérinaire in 1853 by Bouley, continued irrigation has been the classical treatment of pedal arthritis, following necrosis of the anterior lateral ligament or an opening of the lateral cul-de-sac of the synovial. In the paper of Trasbot (1877), there is a remarkable example of recovery: a horse, affected with quittor, complicated with necrosis of the anterior lateral ligament and opening of the synovial, was submitted to irrigations three days after the operation; the wound cicatrized in ten days. Like many other veterinarians, we have obtained similar results. To insure the irrigation of the wound, it is often necessary to apply a drain. The superiority of continued irrigation upon the other means recommended before antisepsy is demonstrated by many facts.

But for quiet animals, easy to dress, we prefer the disinfecting solutions in baths, injections and with dressings. As we write this article,

we have in our care a magnificent animal cured from a pedal arthritis with baths and antiseptic dressings. Hydrotherapy, carried on for twelve days, had failed to produce any improvement.

In the quite numerous cases where lameness remains, high neurotomy, that of the median or of the sciatic, must be resorted to.

VI.

CLOSED IDIOPATHIC ARTHRITIS.

Between closed and traumatic arthritis there is the difference which exists between contusion and contused wound: no foreign body coming from the outside has entered the joint; that explains the rarity of suppuration in closed articular inflammations. We do not speak here of the infectious arthritis; they will be considered farther on. Those that we will examine now result from local causes which, without opening the synovial, promote inflammation in them.

Wounds of joints which are not penetrating, violent contusions, sprains, luxations, epiphysar fractures, are the usual causes.

Closed arthritis is announced by heat, soreness and swelling. The synovial secretes freely; in its inside the fluid accumulates and dilates the weak points, but the peripheric œdematous swelling frequently conceals the dilatations. The characters of the intrasynovial effusion have permitted their division into *serous*, *pseudo-membranous* or *purulent*.

To reduce the inflammatory manifestations is the first indication of treatment. General and local bleeding are useless. Even for the articulation of the foot, the traditional local bleeding at the toe is abandoned; it exposes to suppurative infection of the sub-horny structures. Emollient ointments, poultices, white lotion compresses, camphorated alcohol, are not as good as cold (baths, douches, continued irrigation) or immobilization with an appropriate bandage. "Immobility is, *par excellence*, the antiphlogistic treatment of an inflamed joint"; it insures rest for the tissues and allows the rapid repair of articular lesions. Speaking of sprain of the fetlock, we have shown the beneficial effects of the bandage of Delorme. By the immobility and compression it produces, this bandage constitutes a good treatment for more exposed articular phlogosis. Its application is simple upon the phalangeal joints, that of the fetlock, knee and hock. With the superior articulation of the extremities (shoulder, elbow, hip, stifle) pitched plasters are to be recommended. There is often advantage to combine immobilization with refrigeration. Many practitioners, from the start, use blistering preparations, so as to modify the synovial inflammation; they are ad-

vantageous only when the inflammatory phenomena are moderate or have already subsided.

If the synovial dropsy is very abundant, puncture of the joint must be made. On the most prominent point of the tumefaction, the skin is shaved, soaped and washed with alcohol or Van Swieten. The trocar and hands of the operator should be carefully disinfected. The extracted fluid is sometimes clear, at others a little fibrinous, now reddish or already cloudy and on the road to suppuration. In this last case, the washing of the serous may prevent suppurative arthritis. With an aseptic syringe, or, better, with Dieulafoy or Potain aspirator, an injection is made in the synovial, with a solution of sublimate 1 p. 1000 or phenic acid 3-5 p. 100; this is afterwards drawn out; it is renewed until the fluid that comes out is limpid, and free from the clots that soiled the first injections. The washing finished, the wound is closed with collodion and the region covered with a wadded dressing. Thus the joint is purified as much as possible. But the result is not always favorable; when already pyogenous microbes brought by the circulation to the joint, have begun their depredations, often the joint becomes purulent, and the pus makes its way outside, necrosing the peri-articular tissues. The treatment then must be that of traumatic arthritis.

Closed arthritis, not complicated, leaves often after itself a joint stiff, sore, impotent, with a certain degree of hydarthrosis. Hot effusions, massage, compression, blistering and firing are the means to be resorted to. After a sufficient rest, work can be resumed gradually. At times the chronic form is complicated with periostosis and false ankylosis. (See *Arthritis Deformans* and *Ankylosis*.) When these lesions exist in the lower joints of extremities (knee, fetlock, phalangeal articulations) radial or tibial neurotomies are indicated. Several horses suffering with chronic arthritis of the knee were neurotomized by Möller and did work in trotting afterwards.

VII.

INFECTIOUS ARTHRITIS.

In animals, besides traumatic and essential closed arthritis, numerous other articular inflammations exist, whose pathogeny, for some at least, is yet unknown. They are not due, like the former, to external violence, sprains, action of mechanical, physical or chemical agents; all seem to constitute manifestations or epiphenomena of general or infectious diseases.

We will only name the *glanderous arthritis*, so frequently observed in

former times. Produced by the specific bacillus, its severity depends altogether upon the affection to which it belongs. *Pneumonia, Peripneumonia, variola,* are sometimes accompanied with arthritis, which may assume rheumatismal character and end in suppuration. *Purulent infection* frequently gives rise to multiple arthritis with rapid development. The bacteriological study of the pus of the diseased joints reveals the presence of the staphylococci or the streptococci. *Distemper* may be accompanied with arthropathies. Megnin has seen one case in which recovery was raidly obtained by blisterings and administration of arsenic internally. However, rheumatismal arthritis is rare; the streptococcus of Schütz is essentially pyogenous; suppuration is the ordinary termination of its articular localizations.

Tuberculous arthritis has been observed in cattle, pigs, cats and birds. If articular tuberculosis can be *primitive*, exist in the absence of any visceral lesion, most ordinarily it is *secondary* and represents a single accident of the bacillosis. The experiments of Max Schüller, repeated several times, have shown that it is easy to produce it in bruising a joint in infected subjects. Most of tuberculous arthritis of animals are without doubt occasioned by accidental traumas; the contusion transforms the injured region into a spot of less resistance, opening at the same time the blood-vessels, which pour out their bacilli. The alterations may begin in the synovial, but most ordinarily the epiphysis are affected first; a center of caries is developed and also fungositus which inoculate the synovial; later, lesions are found in all the tissues of the joint. According to their characters, tuberculous arthritis have been divided into various forms—arthritis with hydarthrosis, with riziform granulations, cold abscess, fungoid arthritis—forms which have been as yet but little studied in our animals. According to the virulence of the bacillus and the resistance of the tissue, the lesions are acute, sub-acute or chronic. Articular tuberculosis is not very rare in bovines (Guillebeau and Hess, Möller, Noack, Lucet). Under the name of *rheumatismal arthritis* (Goux), *goutte* (Pradal), *fungoid arthritis* (Requier), have been described in swine arthropathies, whose nature has not yet been determined. If some among them seem to be related to *rachitism* or *rheumatism* there are others which seem of tuberculous nature (Violet). Bergstrand has related a case of bacillar arthritis of the metatarso-phalangeal joints in a pig. Tuberculous arthritis is very rare in dogs. Nocard has seen it once in a cat. In domestic gallinaceans and birds that are kept in captivity, they are relatively frequent. Larcher has given a very good description of their clinical manifestations. When they are in the way of development, the inferior extremities are taken with spasmodic movements; the birds have difficulty to stand on their legs, the walk is

staggering, lame; many stand immobile, as if paralyzed. If one of the superior legs is affected, the animal has difficulty to fly or perhaps is unable to. The joints are the seat of partial tumefactions, first soft, later indurated and without tendency to diminish. Sometimes the various layers which compose them dry off and successively exfoliate; at others they ulcerate; the wounds resulting from this ulceration are fistulous, with fungoid edges, bleeding, and present at their bottom a yellowish scaly or granular matter. Articular surfaces are extensively altered, sometimes the bones necrosed. Bacilli are found in various numbers in the affected tissues and in the peri-articular carious deposits, where in general they are less frequent. We have gathered several cases of tuberculous arthritis of hens, with lesions very rich in bacilli. The researches of Eberlein have shown that, on phthisical parrots, tuberculous arthritis is counted in the proportion of 25 p. 100.

The treatment of articular tuberculosis of animals is of secondary interest. (See *Tuberculosis.*)

I.—Articular Rheumatism.

Acute articular rheumatism, specially common in cattle, observed also in horse, dog and pig, is a special disease, differing from the *pseudo-rheumatism* which sometimes occurs with pneumonia, distemper, pleuro-pneumonia, puerperal infection. To support its specific nature, are invoked: 1, the febrile symptoms and the characteristic initial period of infectious diseases; 2, the simultaneous attack of joints more or less apart from each other; 3, the endocarditis which sometimes comes and complicates rheumatism; 4, its apparition in model stables or where cold could not be incriminated (Friedberger and Fröhner). Cold enters in the genesis of this affection only as an occasional cause.

If bacteriological researches have not yet entirely elucidated the pathogeny of rheumatism of man, they have shown that the diseased synovials contain ordinarily micro-organisms, most commonly staphylococci (Bouchard and Charron). Schüller has found in them a short bacillus, which, inoculated to animals, gives rise to articular lesions.

The beginning, often insidious, may make one suspect the presence of an internal disease. But the lameness, the local pain and hyperthermia, the multiplicity of the joints affected, the ambulatory character of the inflammation, are sufficient to establish the diagnosis. The observation reported by Trasbot in the *Archives* of 1877 is truly typical. During the development of these arthritis, there often occur other rheumatismal manifestations upon the visceral serous, specially upon the endocardium.

As soon as rheumatism is diagnosed, a proper hygiene shall be

prescribed. The patient shall be kept in a warm stable, protected from drafts of air and dampness. In winter, he will be covered with blankets and his legs bandaged. For food, he will receive warm mashes. Bleeding, advocated for a long time, has a doubtful efficacy. Tartar emetic and other agents have also for a long time enjoyed a reputation little deserved. To-day all authors agree in recognizing the superiority of salicylate preparations. Successively the alkalines, salicyline, salicylic acid, have been used, then salicylate of soda, which has shown itself more efficacious than the others. To large animals it is given in doses from 60 to 100 grammes; to dogs, a few grammes only. This agent quietens the pains and lowers the temperature. Lately, antypyrine, exalgine, phenacetine, sulphate of quinine, salol, naphtol, have been recommended; their action is inferior to that of the treatment by salicylates. If this should be contra-indicated (renal lesions, albuminuria), sulphate of quinine and bicarbonate of soda shall be used. Local applications (phenicated or camphorated ointment, that of populeum acid, laudanum, poultices) have but little effect. Suppuration, which is exceptional, is due to a secondary infection.

Chronic articular rheumatism may appear at once under that form or follow the acute state. Swelling and pain vary in their severity. Localized to the legs, the affection gives rise to a continued or intermittent lameness. After a certain time, the articular borders tumefy, crackings are heard in the joint, osteophytes develop on the edges of the articulation. The lesions keep growing, and become *dry deformans arthritis.* The treatment of this chronic form differs little from that of the acute, but is little beneficial. It is again by well understood hygiene, avoiding cold and dampness, the use of salicylates, bicarbonate of soda, arsenic, that improvement of the general condition can be looked for. Locally, tincture of iodine, blisters, cauterization have seemed advantageous. If there is large synovial dropsy, puncture is resorted to. On a steer, Persillet has used with success puncture and compression with wool bandages.

II.—Arthritis of Milch Cows—Post-Partum Arthritis.

This arthritis, also called *pseudo-rheumatismal*, is almost always localized to the stifle, sometimes to the knee or the hock. It is characterized by a severe lameness, swelling of the joint, and synovial dilatations. Studied by Coulbeaux, Pauleau, Heu, Rossignol, Auer, Furlanetto, its etiology has remained obscure for a long time. Pauleau, who has treated more than eight hundred cases, has remarked that "most ordinarily it precedes or follows abortion, or that it manifests

itself after a laborious calving or an incomplete delivery." The same author accuses also barns badly kept, where cows lay always in the dirt. To-day, it is admitted that this arthritis may follow parturition, abortion, or appear as accidents of metritis, of some inflammatory affections of the genital organs, aphthous fever, enteritis, mammitis (Rossignol). It is not yet known if it is determined by an intrasynovial microbian pullulation, or by toxines elaborated in the genital organs. In a case of femoro-tibial arthritis that we have observed, the sowing of the synovia has given cultures of a micrococcus having all the characters of the staphylococcus albus.

Ordinarily, the march of the disease is chronic or sub-acute. In ex-

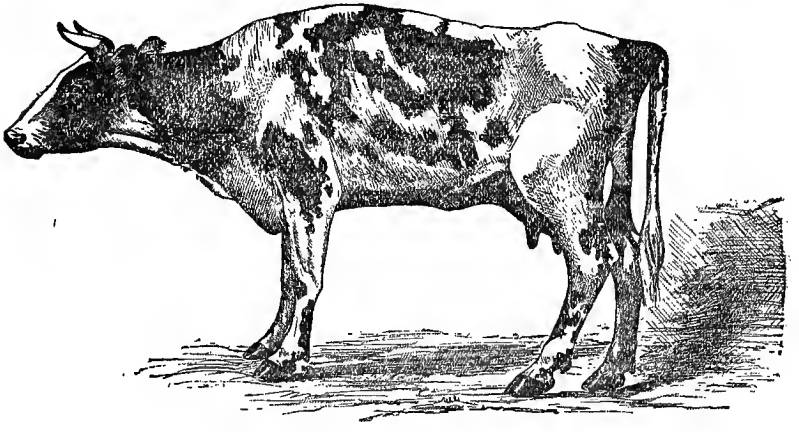


Fig. 113.—Femoro tibio-patellar arthritis. (From a photograph.)

ploring the stifle, one observes a puffy swelling of the region, but the synovial tumors, especially the internal, indicate plainly the articular dropsy. At a more advanced period, the walls of the distended synovial may become calcareous. The process does not end in suppuration. "Never," says Pauleau, "have I seen, at any period of the disease, pus formed in the diseased parts."

The prognosis is serious. The affection is very tenacious; left to itself, it rapidly brings on loss of flesh; death sometimes occurs in marasmus.

Antisepsy of the genital organs after parturition or abortion is at present the only prophylactic indications.

Pauleau and many other practitioners have noted the little efficacy of irritating topics and of the numerous liniments recommended. Cauterization succeeds often. The cow represented in fig. 113 entered

our clinic in August, for a femoro-tibial arthritis; we treated it with needle firing. After six weeks, recovery was complete. Blistering frictions with nitrate of mercury have been recommended (Heu), or those of bichromate of potassa (Guittard). Furlanetto prefers this in the proportion of 4 parts of bichromate to 30 of lard. Pauleau has obtained numerous successes with cauterization by sulphuric acid. Out of 806 cases treated, he only had 57 failures. He proceeds as follows:

"He takes half a decilitre of sulphuric acid sold in commerce and a brush made with a wooden stick, as big as the finger, having a little pad of old linen at one end. The hair is cut over the pre-eminent tumors. The head of the animal is held firmly by an assistant; another, placed on the side opposite that to be operated on, takes hold of the tail with one hand and of the teats with the other; he pulls towards him the mammæ to isolate it from the sick leg, and permits the application of the drug on the inside tumor. The mammæ is covered with a coat of greasy substance to protect it from the contact of the acid.

"With the brush dipped in sulphuric acid, the surface of the tumor is frictioned. A simple embrocation would not be sufficient, a friction of one minute is necessary. Care is taken so that the fluid does not spread beyond the diseased parts, nor drop between the toes. If the animal is affected on both sides together, it is better to operate on the second leg only four or five days after the first. The operation done, the animal is returned to her barn and tied short to prevent her biting herself. After fifteen minutes she is left loose. If the cow show articular lancinating pains, it is proper to make, on the diseased part, several frictions with camphorated alcohol, and only after four or five days, when the animal begins to rest on his leg, to apply the radical treatment.

"Two days after the friction, the external enlargement is entirely flattened, the internal has diminished in size only. The skin, covered with scabs, has the appearance of being tanned. There is scarcely any swelling round the eschar. However, in fine skin individuals, the tumefaction may become very large and run down along the leg. I prescribe only frictions of camphorated alcohol with the addition of a little ammonia (1 part in 20).

"Fifteen days, three weeks, perhaps a month or more will pass before the scabs become loose. Even when the skin is destroyed in its whole thickness, there must be no fear about the sloughs of skin which take place especially at the internal face of the joint, where during walking there are constant rubbings; those sloughs recover perfectly.

"In summer, the wounds are dressed with empyrheumatic oil to keep flies away; in winter tincture of aloes or spirits of turpentine is used.

The definite result of the treatment is most ordinarily a radical cure of the patients." [1]

Rossignol has obtained good results with one simple slight application of trade sulphuric acid.

According to various authors, the sudden arrest of the lochia, occuring in a cow well delivered, will occasion sometimes an arthro-synovitis of the hocks. This affection, already mentioned by Lecouturier, Deneubourg and others, would disappear in a few days. Furlanetto advises the salicylate of soda internally and frictions of warm oil on the hocks. The application on the loins of a sachet containing hot ashes will stimulate the return of the lochia.

III.—Arthritis of New-Borns.

Arthritis of young animals is an affection which occasions considerable losses. Observed in all species, it affects particularly colts, calves, lambs and young pigs. Up to about the middle of this century, it killed about one-fifth of the suckling subjects (Lecoq). In the national haras of Wurtemberg, out of 187 colts that died during a period of fifteen years, 85 were killed by this disease (Hering). Its frequency has diminished with the progress of the hygiene of stables and barns, but its mortality has not diminished in a sensible proportion; it reaches yet 70 to 80 per 100 of the subjects affected. And most of those that survive remain with chronic swellings of the joints or synovial dropsies, with despairing tenacity; hence the axiom of Norman breeders, "Lame colt, lost colt" (Lecoq).

In the majority of cases, pyohemic arthritis occurs in the few days following birth. Out of 67 colts treated by Hering, 47 (70 per 100) died in the three first weeks of life.

No joint is exempt from it, but the hock, knee, stifle, elbow, hip and shoulder, are those most commonly affected; it is, however, quite frequent on the fetlock, the coronet and the costal and intervertebral joints.

The invasion is sudden. Ordinarily preceded by general symptoms, the articular tumefaction, warm, tense, painful, increases rapidly. Almost always several articulations are affected simultaneously. Death may take place after twenty-four or forty-eight hours, but in general the march of the disease is not so rapid; sometimes the inflamed regions open and give escape to purulent synovia.

Few diseases have had an etiology and therapeutics so changeable; few have given rise to so many erroneous conceptions. There have been successively accused: the change of regime imposed on the mother

[1] *Pauleau:* Rec. de Med. Vet., 1869, p. 435.

towards the end of gestation (Lecoq), the bad quality of the milk the privation of the colostrum (Darreau), heredity, exposures to ((Delafond), insufficient feeding (Roloff) . . . and even as far as persistency of the foramen of Botal! Bollinger was the first to cons the disease as an infection having its origin in the inflamed suppura umbilical cord. The infection of the wound of the umbilicus, through putrid decomposition of products covering the soil of stables or barns, the starting-point of the morbid process. Bollinger mentioned as pre posing conditions: the pullings of the umbilical blood-vessels at time the cord is torn, its rupture on a point too near the abdomen, contusions of the umbilical wound, traumatisms of the abdominal w and, lastly, birth during a cold season. The long sojourn of animal stable, increases in it the proportion of putrid matters, and thus motes the infection of the umbilical wound.

Morot reconsidered this etiology in 1884. For him, the cause of the trouble is the persistence of the urachus; it is the pouring of urine, which ferments, becomes irritating, and afterwards brings on inflammation of this canal and omphalo-phlebitis. He advises to t the urinary fistulas by cauterization or ligature. By leaving a cert length to the cord, and protecting it from injurious contact by a li bandage, these fistulas are prevented. Chassaing claims that exuda and purulent arthritis are two distinct diseases. The first is due t sickly condition of the mother and the bad quality of the milk, while second is caused by the inflammation of the urachus or of the umbil vein, as taught by Bollinger. Cagny insists in believing that umbil phlebitis and arthritis of young animals are two distinct affections; finds them very different in their march, and it is only exception that they have been observed on the same animal; for him, umbil phlebitis is followed by death in the eight days following birth, bef the appearance of the articular symptoms, while the arthritis ha slower march, attacks successively various articulations, and in gen kills only after complete cicatrization of the umbilical vein. But th numerous forms of the disease, these differences observed in its ma nancy and march, seem to be the result of the diversity of micro-organis able to promote it, or of the degrees of virulence of its producing ag in admitting that this should be unique. It is considered as dem strated to-day that pyohemic polyarthritis of colts, calves, lambs young pigs is, as announced by Bollinger, a general infectious ease, beginning by a phlegmasia of the umbilical cord and produ by the agents of this inflammation, principally by the streptococcus garis (Nocard, de St. Germain).

The treatment has considerably varied, according to the admit

pathogenic doctrine. Lecoq advised bleeding, repeated emollient lotions, cold baths, lotions with sulphate of iron; the mother was submitted to a severe diet, and the young one deprived of part of its ration. Darreau praised purgatives (sulphate of soda, aloes), with applications of populeum on the joints. The infectious theory of the disease calls particularly the attention to its *prophylaxy*: avoid the infection of the umbilical cord, purify it with strong antiseptic solution if it is soiled; keep the place where the animal is as clean as possible; such is the indication. Bollinger recommends to ligate the cord, assist the cicatrization of the umbilical wound with antiseptics and apply on the abdomen a protective bandage or more simply a coat of tar. The stable should be well aired; the fæces and dirty bedding removed often.

The curative treatment includes the disinfection of the umbilical region (phenic or cresyled water) and the application on the wound of antiseptic vaseline. Some practitioners continue to give purgatives (sulphate of soda and cream of tartar); others antiseptics (calomel, salol, napthol). Salicylate of soda (2 to 8 grammes) has little effect. Stimulants (alcohol, wine, coffee) are indicated to sustain the patient. Against the articular tumefactions, therapeutics can do but little. To the populeum will be preferred vaseline, with or without antiseptic or narcotic substances. If suppuration occurs free exit must be allowed, by opening the collection, and then treat with antiseptics. Muscular abscesses demand the same means. But when such serious lesions exist it is more economical to sacrifice the subject.

Against chronic articular swellings blisterings and cauterization will be resorted to. As remarked by Darreau, those synovial tumors are ordinarily very difficult to remove.

VIII.

HYDARTHROSIS.

Dropsies of articular synovials have numerous causes—contusions, luxations, sprains, peri-articular wounds, inflammations of joints. Often during these affections the articular synovial "swells more or less painfully" on its weak points through an effusion which takes place in its cavity. Sometimes these phenomena gradually diminish and leave nothing after them; at others, the acute symptoms diminish and the hydarthrosis remains. In animals used as motors, they are ordinarily seen developing without noticeable inflammatory manifestations. Soft, fluctuating tumors, painless, appear in some parts of the joint; they increase little by little, and at last give rise to lameness. Few horses, used for a long time to hard work, are free from them. Let us remark

again that the joints in which motions are most active are also tl that are more affected. It is, indeed, in the fetlock, hock, knee stifle that they are most ordinarily observed. Lymphatism and here have been incriminated as cause. Certainly there are animals in wl hydarthrosis occurs without being promoted by efforts, or hyperfunc of joints, but, without contestation, exaggerated work is the great o sional cause. Let us add that some dropsies have special causes. T have been seen to appear during gestation, and disappear generally parturition, and without being serious. There are some which dev after delivery, and are more serious than the preceding ones. Ag various morbid conditions, general or infectious, particularly rheu tism and distemper, may be accompanied by them.

At the onset of some hydarthroses are sometimes seen a little h pain on palpation and a slight lameness; but in general the dis develops slowly, without producing lameness at the beginning. L by little the synovial tumors enlarge, harden; the fluid, secretec abundance, may become the cause of a lameness resulting specially f the obstacle its accumulation opposes to the free function of the jc At rest, the animal assumes a special position corresponding to capacity maxima of the serum. In old dropsies, with abundant e sion, there is sometimes separation of the bony surfaces and a true ation takes place. At the autopsy of a horse suffering from an old la ness of the hip, Vitet found "such relaxation in the coxo-femoral jc that the head of the femur would at times leave the cotyloid cavity return into it without difficulty."

With the exception of some rare cases, the diagnosis is easy. each joint the synovial makes hernia in special places, always the sa which permits the differentiation between hydarthrosis and hygromas dropsies of tendinous sheaths. Sometimes the clinical physiognom modified by the presence of one or more septums in the dropsical ser The distentions of one cul-de-sac may be wanting or only sligl accused.

The prophylaxy of hydarthrosis must be guided by the considerat of the causes promoting them. Acute affections of joints (wounds, c tusions, sprains, luxations, arthritis) shall be treated according to indications we have presented; the active function of the articulat shall be avoided before the complete disappearance of the inflammat symptoms. The influence of exaggerated work, not in proportion w the age, the resistance of the tissues, demands the methodical train of young animals. A more judicious selection of the breeders is rec mended. "Males which are subject to hydarthrosis ought not prop to be used for reproduction. Females affected with them must be ser

by stallions with dense tissues. They ought to be used to breed mules. Subjects born of parents affected with hydarthrosis ought to emigrate towards dry localities. For them aqueous food is contra-indicated. Feeding with oats, beans and the like is often sufficient to bring on the disappearance of these affections. But it demands six months and sometimes years to reach this modification." [1]

The treatment varies according to the age and the degree of the dropsy, the modifications of the synovial and of the tissues surrounding it. Against recent hydarthrosis, a number of means are recommended. Rest of the joint is always beneficial; it stops the effusion and favors the absorption of the synovia. Complete immobilization is impossible in animals, and it is not necessary; the subject is turned loose in a box or in the field. Compressions, much used in stables of the rich, helps rest with advantage. The joint is wrapped with linen or flannel roller from below upwards with quite strong compression; this is increased by wetting the roller before its application. To-day, especially for race-horses, rubber stockings of various shapes are used. Some, passed over the hoof, come to envelop exactly the diseased joint; others are laced with strings; all have the advantage of resisting in a permanent manner the dilatation of the synovial.

To compression astringents are frequently added: white lotions, styptic solution, alcohol, tincture of camphor, poultices of clay, paste of common chalk diluted in vinegar. Cold water is yet, with immobilization, massage and compression, the treatment par excellence of recent hydarthrosis. Douches and baths in running water may be utilized. After each seating of hydrotherapy the joint may be massed and enveloped with a roller or a rubber stocking. Against hydarthrosis, aloes, sulphate of soda, squill, colchicum, nitre, and all the series of diuretics have been administered internally. These remedies have no action upon the affected synovial serous.

When hydarthrosis have reached a certain size, these treatments are no longer sufficient. More active measures are necessary. Blistering applications are then indicated: tincture of cantharides, blister ointment, English and French strong liniments, those of Geneau, Boyer, the topic of James, the ointment of Lebas, that of Méré, those of biodide of mercury or bichromate of potassa, and a mass of other preparations with known or concealed composition, all have been recommended.

Even tincture of iodine, in frictions, has had its advocates. Delrée has praised it: "The treatment that I use has given me complete recoveries, without relapse, loss of hair, even in well-bred horses, with-

[1] L. Lafosse, Pathol. vét. t. II, p. 616.

out leaving a blemish and without preventing the animals from doing their regular work.

"The therapeutic agent that I use is iodine in the following formula:

Tincture of iodine	100	grammes
Iodide of potassa	5	do
Distilled water	40	do

"The skin being well covered with this solution, and the hand protected, a friction of ten to fifteen minutes is made, and renewed twice a day. After each friction, the skin is coated with a greasy substance (lard or populeum).

"After a few days, the skin becomes parchment-like, the tumor softens, diminishes little by little, and ordinarily disappears after four or six weeks of treatment. I must, however, remark that it is hard to obtain the complete disappearance when there are clots of synovia deposited in the cavities." [1]

In our hands, tincture of iodine has not proved itself superior to the other counter-irritants, but the contrary. Delrée has been obliged anyhow to rub it twice a day for four to six weeks. Blisterings have given more rapid and at least as satisfactory results. In our clinic we use almost exclusively simple blister ointment, the mercurial or the bi-iodide of mercury: their action is strong and without severe itching.

Blisters and tincture of iodine can be used alternately. "Often," says Lafosse, "after the use of a blister, I make the scabs drop by rubbing them with oil of iodine or an alterative ointment, then I prescribe one friction of tincture of iodine for four or five mornings in succession, to be done over again if the recovery is not complete." The same author has obtained good results with plasters made of pitch, turpentine and wax, applied warm over the synovial tumors. This treatment produces derivation and immobilization; it also makes a regular and lasting compression over the synovial tumor, which is very beneficial. The nature of the blistering agent has not the importance that has been attributed to it. A simple coating of the hair with a brush, by a blister, gives little or no effect; a stiff friction, properly made, will produce beneficial results. From the sixth to the eighth day, hot-water lotions are made to soften and wash off the scabs; douches, massage, compression do the rest.

With large, old, indurated hydarthrosis, cauterization must be resorted to. Instead of superficial points firing, we prefer that in lines, in fine points or in needles. The accidents of arthritis spoken of are due, not

[1] Delrée, Annal de Med. Vet., 1864, p, 456.

to the method, but the lack of ability or of experience of those who use it; providing the points used are sufficiently fine, no accident is to be feared, no more for articular synovial than others. With Paquelin and Bourguet needle or the zoocautery, we pierce the synovial in its most superficial parts; the synovia escapes, the serum remains aseptic; the therapeutic effects are in general superior to those of superficial cauterization; the escape of a certain quantity of fluid is allowed, which, with the other means, will be resorbed; the heat carried in the synovial produces beneficial changes and on the level of the punctures little fibrous spots are formed whose retraction forms round the joint a true contentive bandage of great power. Cauterization is the most used and most practical treatment. It is certainly, as said Lafosse, "the truly heroic treatment."

Efficacious as it is, firing is not infallible,—and it blemishes. On that account, and specially for fine horses, other therapeutic means have been looked for, to take its place. It is centuries since it has been thought to give escape to that synovia, often thick, grumulous and with difficulty resorbable. From time immemorial, Arabs opened the thoroughpins of their horses with the red iron. Bruché (1826) punctured hydarthrosis with the iron carried to white heat, and when they were voluminous, he enveloped them with points of firing. From time to time we yet meet with arthritis of the hock or the stifle, consecutive to the opening of hydarthrosis with the cautery—an operation which is still performed by horse-shoers and empirics. Already Garsault and a number of others of the last century, passed, through thoroughpins, setons animated with "ointment of scarabee." The puncture with the bistouri has counted many convinced advocates. In 1826, Cross addressed the *Société Centrale d'Agriculture* with a paper on the "Recovery of Dropsies by Puncture with the Bistouri." Dard, Roettger, Fischer operated often that way and completed the operation by a bandage and a blistering friction.

These primitive methods have caused many "disasters": often they promoted articular inflammation, which soon cools down the most enthusiastic. To be useful and harmless, the puncture must be *capillary* and made in conditions of perfect asepsy. The skin should be shaved, washed, disinfected. On the prominent point of the hydarthrosis, the aseptic trocar should be thrust in the synovial, by a sudden motion of terebration. It is not necessary to make the puncture subcutaneously, in which the instrument, after running through the skin, passes in the cellular tissue, one or two centimeters, before entering the synovial. As soon as the rod is taken off, the fluid escapes through the canula; small squeezes over the tumor stimulate the flow. With a Dieulafoy or a

Potain the serous is more completely emptied. The synovia returns rapidly, but ordinarily in less quantity; successes have been obtained with simple repeated punctures. However, in the majority of cases, puncture is completed by compression, blistering, cauterization or modifying injections. We generally add to it the lines or deep points firing, according to the seat and dimensions of the hydarthrosis.

To change the condition of the synovial, it has been injected with various fluids. For a long time, the operation has seemed most dangerous. Bouley said: "Knowing the alterations, often irretrievable, that the inflammation may produce when it occurs in those parts, specially after a traumatic lesion, it is difficult to believe that injections, no matter of what nature and how carefully they may be made, would give rise to an inflammation limited only to the necessary degree required to modify the secretion of the synovial membrane and still remain unable to alter the structure of the parts." We will not give the technic of the operation; it is already done. (See *Dropsies of Tendinous Synovials*). Among the agents used, tincture of iodine is the most in vogue. Leblanc and Thierry, after experimenting with it on animals and having obtained good results, recommended the injection of tincture of iodine to the third (tincture 1 part, water 2), for hydarthrosis as well as for tendinous sheaths. Serious accidents were soon recorded in Alfort, by Bouley; at Lyon, by Rey; at Toulouse, by Lafosse, then by a number of practitioners. These unfortunate results caused the iodine injection for the treatment of hydarthrosis to be put aside; but they took place at the time when asepsy was ignored. With it, the method succeeds.

Schede has made known the first successes obtained in man by the articular washings with strong phenic acid. Many surgeons who employ this method have found it excellent, and the operation of Schede has received its "clinical consecration." The following observation of Labbé deserves to be mentioned. A man thirty-one years old suffered for seven years with hydarthrosis of the knee. When the author was called, the articulation was enormous, distended by a great quantity of fluid; the muscles of the thigh were much atrophied. Puncture was made with a large hydrocele trocar; 4 liters of phenicated water, 5 p. 100, were used to wash the joint thoroughly; the puncture was closed with collodion taffetas and the joint wrapped in a thick wadded bandage, tighly applied; the whole leg was held in immobility. Eighteen days later, "the knee had resumed its normal aspect. The outlines of the joint were as well marked as those of the healthy articulation, a condition which had not existed for seven years."

Sometimes a trocar of some large dimension has to be used to permit

the escape of the clots that the iodine or phenic acid make with the synovia, and which sometimes prevent the washing. So as to prevent the coagulation, Nocard has recommended solutions of thymic acid 1 or 2 p. 1000.

Starting from this fact, that ergotine and morphine "reduce secretions," Laffitte has tried a mixture of equal parts of the two following solutions :

Ergotine	1 gramm.
Distilled water	40 do
Muriate of morphia	0.50
Distilled water	35 do

Stottmeister has advised solution of eserine 1 p. 100 (5 to 10 grammes to a dose).

After these modifying injections, moderate pressure (flannel, linen or rubber) with immobilization, or a blistering friction, can be used. Like Bassi, many practitioners prefer the blister to the bandage.

Against hydarthrosis which have resisted penetrating firing and modifying injections, *arthrotomy* can be resorted to. It comprehends the same rules as synoviotomy. The region, material of operation, surgeon and assistant must be thoroughly aseptic. Hemostasis is obtained with a rubber cord. With an incision made parallel to the large vessels and nerves, the synovia is allowed to escape, the false menbranes are removed, and the synovial membrane carefully cleaned out. Sometimes a piece of skin has to be excised on both edges of the wound. This is closed by sutures ; a drain is left at the lower commissure ; and the region covered with an antiseptic bandage, and immobilized as much as possible. This is a delicate operation, which exposes to most severe complications, if asepsy has failed. Gunther and Möller have condemned it. Notwithstanding some late success, their judgment needs no revision. We can only repeat what we have said on tendinous dropsies in general ; in the ordinary circumstances of our medicine, if one does not wish to run big risks, let him continue and prefer the cautery to the bistouri ; leave arthrotomy to the virtuoso and the lover of cutting.

Let us resume the therapeutics of hydarthrosis. At the beginning, prescribe rest, douches, cold baths, astringents, compression, massage. If these fail, use blistering and again hydrotherapy and massage. When the dropsy is abundant or already old, and the peri-synovial tissues indurated, resort to firing in lines, in fine points or in needles.

Hydarthrosis of Extremities.

I.—Scapulo-Humeral Joint.

Although very extensible, the synovial of the shoulder-joint does not protrude externally when it is dropsical. This condition is accused by lameness and stiffness of the extremity, which is carried forward with difficulty; in some cases, the point of the shoulder is deformed by a diffuse swelling. The sheath of the coraco-radialis, which, in solipeds, is independent of the scapulo-humeral synovial, may be the seat of a synovitis, sometimes mistaken for the lesions of the articulation.

Fig. 114.—Hydarthrosis of the elbow (from a photograph.)

Lines or deep points firing is the only beneficial treatment.

"In tetradactyles, dropsy of the articular capsula may be manifested by a double soft tumor, which appears on both sides of the coraco-radialis muscle, that is, at the antero-inferior part of the point of the shoulder. The reason is that the capsula extends downwards and forwards, to line the internal face of the muscle in question, and that it is not longer sufficiently protected on the sides of this muscle, to be prevented from distending on this point when it becomes the seat of a dropsy" (L. Lafosse).

Cauterization is also the choice treatment.

II.—Elbow Joint.

In his *Traité de Pathologie*, Lafosse wrongly states that this joint is never the seat of hydarthrosis. We have seen two cases of it at the Alfort clinics; many practitioners have related examples of it. Here is the resumé of one of our observations:

Five-year-old horse, working for six months. When shown to us, its

gait is shorter for some time. At rest, the left anterior leg is held forward of the plumb line, resting on the plantar surface; in walking, the movements of this leg seem stiff, and when the animal is tired, lameness appears. Towards the inferior part of the mass of the extensors of the forearm, at the external face of the elbow, on a level with the tendon of origin of the external flexor of the metacarpus, there is seen a bi-lobulated tumor whose great axis, measuring 12 centimeters, was running obliquely downwards and forward. Both dilatations, separated by a slight depression, were hard, tense, when the leg was resting; they became less apparent and softer as soon as the leg was flexed. It was a hydarthrosis of the elbow, a distension of the cul-de-sac which lines the tendon of the external flexor of the metacarpus; the inferior dilatation had taken place in front, the other back of this tendon (fig. 114). With a capillary trocar, an aseptic puncture was made on the lower pouch, which allowed the escape of about 150 grammes of synovia. A blister was applied on the external face of the joint. Three weeks after, the dropsy had returned, causing a great stiffness of motion. With a new aseptic puncture and a deep pointed firing on the external face of the elbow, the hydarthrosis disappeared completely and the leg recovered the entire freedom of its movements.

Fig. 115.—Hydarthrosis of the knee (from a photograph.)

III.—Carpal Articulations—Articular Thoroughpins of the Knee.

Besides the ligaments proper to each one, carpal articulations are held together by four common ligaments, which allow the distension of the synovials that line them, to take place only in given parts. The radio-carpal hydarthrosis is shown by the existence of two tumors: one, round in form, from a nut to a man's fist in size, is situated on the external face of the region, a little above the trapezium, between the posterior face of the radius and the external flexor of the metacarpus (fig. 115); it is formed through the narrow solution of continuity which exists between the posterior common and the radio-suscarpal ligaments; old, it is often indurated or calcified. The other occupies the anterior face at the junction of the knee and the forearm. Hydarthrosis of the intercarpal joints gives rise to two or three hemispherical tumors,

situated towards the middle of the anterior face of the knee between the extensor tendons; tense when the leg is at rest and simulating exostosis, they are soft and fluctuating when the leg is raised, unless their walls are indurated or calcified. As to the carpo-metacarpal synovial, narrowly supported by the ligaments surrounding it, it can be the seat of no distension visible externally.

The radio-carpal hydarthrosis, by far the most frequent, is well characterized by the tumor resulting from the dilatation of its external cul-de-sac; that produced by the distension of the carpal tendinous sheath, less circumscribed and situated more backwards, alongside the deep flexor of the phalanges, co-exists with an elongated, cylindrical tumor, which occupies the superior third of the cannon and surrounds the tendons. It is easy to differentiate the intercarpal hydarthrosis from the dropsies of the sheaths of the tendons, which are more superficial and elongated in the axis of the leg. For the hygroma of the knee, its situation is subcutaneous.

It is again with blisterings and firing, sometimes also by puncture, that those hydarthrosis are treated. The radio-carpal hydarthrosis is more accessible to trocar, and the inter-carpal nodosities, less voluminous, disappear ordinarily with deep firing if applied early.

In cattle, Latffite has proposed the use of injections of morphine and ergotine. But in those animals, as in horses, cauterization is the indication.

IV.—Coxo-Femoral Joint.

The large muscles which surround the hip-joint do not allow much dilatation of the synovial. However, Vitet and Rigot admit the existence of this hydarthrosis. We have related the observation of Vitet, in which the relaxation of the joint by the accumulation of synovia was so marked that the head of the femur would slip out of the cotyloid cavity.

The diagnosis of these lesions is difficult, exceptionally rare; they interest the anatomo-pathologist more than the practitioner. Subcutaneous firing would be the therapeutic means of choice.

V.—Femoro-Tibio-Patellar Joint.—Patellar Thoroughpin.

The stifle joint has three synovials: one superior and two lateral. The first, very large, supported by the femoro-patellar capsula, helps the gliding of the patella upon the femoral pulley and extends in cul-de-sac under the insertion of the triceps cruralis. The two others, that lubrify the articular surfaces of the femoro-tibial joint, line the posterior ligament, the laterals and the fibrous fasciculi that attach the menisci

The external of these cul-de-sacs covers, besides, the tendon of the popliteus and furnishes a small prolongation which runs down the groove of the tibia to envelop the tendon common to the anterior extensor of the phalanges and the flexor metatarsi. These two synovials communicate quite frequently, not to say always, with the femoro-patellar synovial. All three are separated from the tibio-patellar ligaments by a mass of adipose tissue (Chauveau and Arloing).

Patellar hydarthrosis is characterized by a diffused swelling of the stifle, more accused inside than outside; the tibio-patellar ligaments are less distinct and concealed by an elastic swelling. Flexion of the joint is difficult, the leg is stiff, its movement forward very limited.

This hydarthrosis seldom gives away to blistering applications. Dandrieu (1836) said he obtained a rapid success by puncture with a bistouri, but an attentive reading of his article seems to show that the author had a subcutaneous sero-fatty collection to deal with, instead of a hydarthrosis. Charlot and Valtat, after opening the synovial with a bistouri, have seen a fatal arthritis occur. We generally treat this disease by an aseptic puncture with a trocar and with firing in lines, fine points or needles. That is the treatment that Viseur recommended in 1875. The Observation I. of his paper relates to a patellar thoroughpin which had resisted several treatments; the tumor was voluminous, tense, painful on pressure; in walking, the animal dragged the leg with a movement of circumduction. Puncture was made with a trocar of small caliber; on the flattened tumor, "a deep pointed firing was applied, through the skin only, as in Leblanc's method," and its action completed by a blister. In fifteen days the subject received walking exercise. Shortly after, the lameness disappeared and the horse resumed his work. On another subject, the same result followed the same treatment. We could add numerous facts as evidence of the efficacy of this method.

The injection of iodine, used unsuccessfully by Rey, has given good results to Verrier. On a two years' colt (Obs. IX of his report), suffering with very large patellar hydarthrosis, two injections had to be made some time apart; there was no complication; after three months recovery was complete. In case of failure after puncture followed by firing, washing by the method of Schede might be resorted to. In several cases, Mollereau has used with advantage a solution of thymic acid at 2 p. 1000.

In horses and dogs the femoro-tibio-patellar joint is quite frequently affected with arthritis deformans, clinically manifested by lameness, stiffness of the leg, bony neoformation on the articular extremities and often also, in horses, with a certain degree of hydarthrosis. The

careful examination of the diseased joint allows the diagnosis. The prognosis of this arthritis is always more serious than that of the simple patellar thoroughpin. It resists all treatment. (See *Arthritis Deformans.*)

VI.—Tarsal Joints—Articular Thoroughpins of the Hock.

Due to dropsy of the tibio-tarsal synovial, this hydarthrosis is characterized by three tumors, fixed in their location but varying in their size. One of them occupies the antero-internal region of the hock[1]; two are situated behind, between the tibia and the calcanean cord, above the lateral ligaments; one of these last can be absent; the other, existing with the anterior, characterizes well the articular thoroughpin, which is generally more frequent than the tendinous.

At the beginning, cold water, astringents, massage, tincture of iodine externally may be useful. Halley has recommended setons under the skin, carefully avoiding the synovial; this is dangerous and not used. Ordinarily, blisters are used. For a certain number of cases, their application is followed with a marked diminution in the size of the tumors; but the most recommendable treatment is cauterization, firing in lines or penetrating points. Horn allows the escape of the synovia, and then applies a compressive bandage on the hock.

Intra-synovial injections have been advised by Leblanc. In 1861 he published facts showing the efficacy of injections of iodine. The patient of his Observation I. had an enormous hydarthrosis; two injections had to be made a month apart; recovery was complete. In Observations II. and IV. the subjects had to be treated twice; with them also the dropsy disappeared in a few months. Abadie and Dupont have obtained many times good results with injections of iodine. But Bouley, Rey, Lafosse, Verrier and others have had accidents. Bouley tried this treatment in a horse affected with a large thoroughpin, from which eight deciliters of synovia were removed through the puncture; a solution of one part of tincture of iodine against three of water was injected; part of it only could be removed, albuminous clots having closed the canula. A high fever followed; six days after, the animal was unable to rest on his leg, pain was excessive; a puncture was made on the external tumor, from which escaped a yellowish fluid, already purulent. Multiple abscesses formed round the joint. Twelve days after the horse died. With him ended the treatment of articular thoroughpin by injections of tincture of iodine. To this day, phenic acid, thymic acid, have not been much utilized; no more than other antiseptics. Zimmer is said

[1] The blood-spavin of English.

to have obtained good results with puncture and the injection of sublimate corrosive 1 p. 1000 followed by a blister.

Laffitte in 1886 has said much in favor of a mixture equal parts of solutions of ergotine and muriate of morphia. His Observation I relates to a bull which had a large thoroughpin which had resisted blistering; the injection made, the wound was closed with a stitch, a compressive bandage was applied on the joint; a month later, recovery was complete. A heifer and a mare were cured by the same method.

Fig. 116.—Hydarthrosis of the fetlock.

The "baring of the veins" has been advised.—a fantastic operation consisting in ligating the vein: 1st, below the bony projection where spavin grows; 2d, on the inside of the leg, immediately below the small venous branch coming from the anterior tibial muscles. When both ligatures are applied the vessel is open in its whole length between them. A quite abundant hemorrhage takes place, which when it stops indicates the end of the operation. Slight pressure and tepid lotions on the joint continue the treatment.

This fantastic operation is said to have been successful in colts. But it must be remembered that with them thoroughpins disappear as the animal gets old. If the treatment has any effect it must be only by the local irritation it produces.

Gloag has treated hydarthrosis of the hock by acupuncture: two seatings, five days apart; the last followed by an application of tincture of iodine and a compressive bandage.

Puncture followed by lines or penetrating pointed firing is the select mode of treatment.

VII.—Articulations of the Fetlock and Foot—Articular Windgalls.

The articular synovial of the fetlock is strongly protected in front and on its lateral faces. Its hydarthrosis is accused by two dilatations, situated above the sesamoids, between the cannon bone and the suspensory ligament; one on the inside, the other on the outside. These tumors, whose dimensions are rarely larger than that of a large nut, are hard when the leg is at rest, soft and fluctuating when it is raised. With profuse dropsy there is also in the pastern, along the middle and super-

ficial sesamoid ligaments, several smaller nodosities. In time the peri-synovial tissues become indurated, calcified or ossified.

The treatment comprises: At first, antiphlogistics, compression, massage or blisters; later, puncture with firing in lines, fine points or needles. In rebel cases, with asepsy, injections of phenicated water (3-5 p. 100) or of sublimate (1 p. 1,000) might be attempted. Immediately after the operation a wadded dressing or a roller of rubber should be applied.

The *synovial of the foot* may dilate on the level of its lateral culs-de-sac and constitute two little windgalls above the cartilages. Their symmetrical position, their tense condition when the animal is at rest, their softness when the foot is raised, are sufficient to distinguish them from cysts and side bones.

Generally they give rise to no lameness and demand no treatment. If they did, blisterings, or firing if those are insufficient, must be resorted to.

IX.

DRY ARTHRITIS—ARTHRITIS DEFORMANS

Quite common in horses, cattle and dogs, *dry* or *deformans arthritis* may affect all joints. Anatomically it is specially characterized by the wearing of diarthrodial cartilages, the production of osteophytes and the deformity of articular surfaces. The affection is sometimes mono-articular, limited to one joint; at others polyarticular. Goubaux has seen it in all the joints. It is relatively frequent in the hock, knee, fetlock and coronet (Stockfleth). Dry arthritis of the knee gives rise to some of the osselets; that of the hock promotes the most serious variety of spavins; that of phalangeal joints, number of ringbones. We have often observed it at the stifle in horses and dogs; it is more common in heavy horses and large dogs; sometimes it is unilateral, at others the two joints are affected. Dry arthritis of the hip is rarer; we have seen a few cases in dogs; Möller and Siedamgrotzky have seen it in the horse. At the museum of the veterinary school at Berne there is a skeleton in which almost all the joints are affected. At the autopsy of a horse treated without success for a "general stiffness" of the four legs, Niebuhr found all the joints diseased. Sticker has recorded a similar case.

The nature of dry arthritis is yet in discussion. In man, the rheumatoid origin has been sustained by Charcot. For Weber it is the result of a lesion of the spinal cord and of the nerves. But traumatic lesions, such as luxations, can end with arthritis deformans. According to Quenu, it "is not a special disease; it is a mode of termination of all

species of chronic arthritis, whether it is due to rheumatism, traumatism, or even through a disease of the nervous system. *Arthritis deformans* would be a possible result of most of the arthropathies; its physiognomy would be due less to the primitive nature of the arthritis than to the general nutrition of the subject and the local condition of the affected leg.[1]

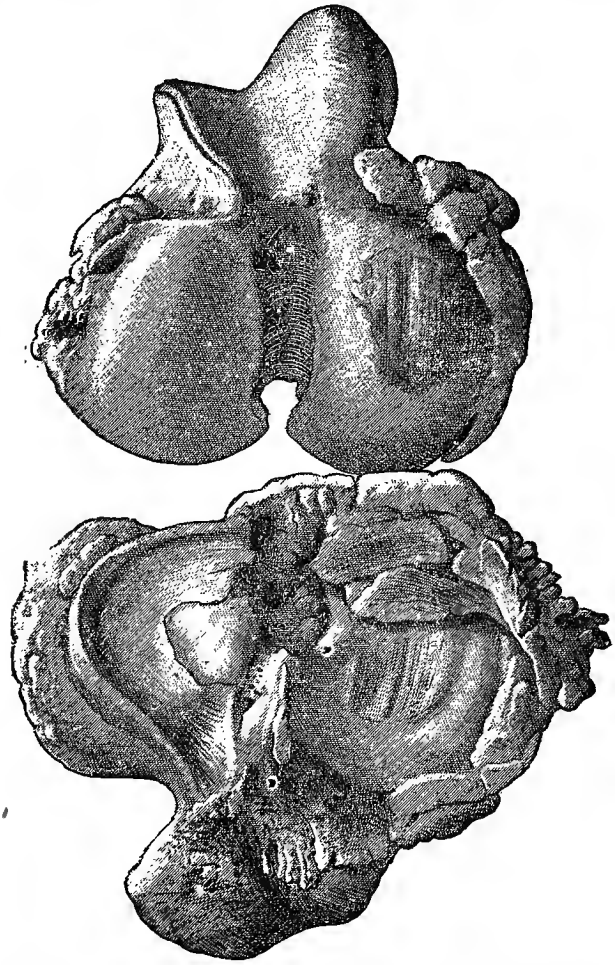


Fig. 117.—Dry arthritis of the stifle joint (from a photograph).

Monoarticular, they sometimes have a traumatism for cause; polyarticular, it is ordinarily related to a general affection. The lesions, always characteristic, are the result of two simultaneous processes: one destructive, producing the elimination of the epiphysar cartilages and the

[1] *Quenu:* Traité de Chirurg. de Duplay and Reclus, t. III., p. 414.

wearing of the bony surfaces; the other productive, bringing the formation of cartilaginous vegetation (ecchondromas) or osseous (osteophytes). The epiphysar cartilages undergo the velvety change; their central portion, which receives the greatest pressures, is eliminated. The bony surfaces that are in contact become eburnated, ivory-like or marked with fissures. At the periphery, cartilaginous neoformations, which soon ossify, are seen. The ligaments, articular capsula and muscles contribute also to the formation of these bony deposits. If sometimes there is synovial hypersecretion, it is ordinarily a rule to find in the joint only a very small quantity of thick, reddish fluid; sometimes even the dryness of the joint is complete. The serous is generally red, vascular, covered with villosities. Articular foreign bodies are frequent. The interarticular ligaments, meniscus (stifle and temporo-maxillary articulation), are always much altered, sometimes entirely destroyed.

For articulations that can be easily explored, the deformity of the joint, the slow development of the process, its chronicity, allow the diagnosis. In the horse and dog the femoro-patellar dry arthritis is easily made out. The animal is lame on one hind leg, and on exploring it the stifle is found voluminous and the articular extremities swollen.

The march of the disease is continued and progressive; prognosis almost always fatal. Yet, working animals can be used at slow work (walking) for a more or less long time.

Blisterings, intrasynovial injections, firing, fail just as much as cold, hot moisture, compressions or massage. In dogs, we have obtained some slight improvements with needle firing. In horses, if the disease was located on the lower regions of the legs (knee, fetlock, coronet, foot), neurotomies might permit the utilization of the subjects for some time longer.

X.

ARTHROPATHIES IN NERVOUS AFFECTIONS.

The influence of the nervous system upon the nutrition of bones and articulations is yet little known. Experimentation has shown, however, that simple nervous sections are rarely followed by osteopathies and arthropathies. Those would rather occur when neuritis or myelitis come to complicate the nervous trauma. Exceptional in animals, they are frequent in man after pricks, shotgun wounds and others accompanied with neuritis. Various affections of the spinal cord (traumatisms, compression, chronic inflammation, locomotor ataxia) or of the brain (hemorrhage, softening, tumors) may also give rise to arthropathies.

Treatment is that of the causal affection. No local interference can do any good.

XI.

FOREIGN BODIES.

We will not speak here of the foreign bodies coming from outside (projectiles or any other sharp metallic substances); but only of those that develop in the synovial or the parasynovial tissues. Arthrophytes are rare in animals; they have seldom been observed, except in horses. Goubaux has found them in the femoro-patellar, tibio-tarsal and temporo-maxillary joints; Bruckmüller in those of the shoulder and elbow; Roloff in the hock; Stockfleth in the hock and in the knee. Möller has made them out in the knee during life. We have observed them in the knee, fetlock and stifle joint. The bodies exist specially in adults or aged subjects. Sometimes also in young animals. Stockfleth has seen them in the hock of a six months' colt.

If their pathogeny is still doubtful, it is now known that their origin varies. The riziform granules, which we have mentioned in tendinous synovials, in hygromas, seem to result from the inflammatory exudate deposited on the surface of the synovial. Free or pedunculated, the organized foreign bodies are of fibrous, fatty, cartilaginous, osteo-cartilaginous or bony nature. Most often, they are connected with dry arthritis and all the tissues of the joint seem to be able to give rise to them. There are arthrophytes of traumatic origin which are only pieces of normal tissues torn from the epiphysis by blows, knocks or any other traumatic actions. They have been seen ready to get loose from the articular surface to which they were attached only by a single peduncle. Sometimes they are single, or again exist in various numbers. Their volume varies ordinarily between that of a shot to that of a pea; exceptionally they may be as big as a pigeon's egg. Most of them are rounded, sometimes having one depression resembling a hilus. In animals, foreign bodies of synovials have no relation to tuberculosis.

These bodies may remain a long time in synovials without producing any disturbance; but it happens—no doubt when they engage themselves between the articular surfaces, under a ligament or a tendon—that they give rise to sudden lameness varying in duration. All of a sudden, while at work, the animal goes on three legs; the lame leg is stiff, as if there was a luxation; there is great pain. These symptoms subside all at once or only little by little. In a superficial joint, palpation, carefully made, might permit the diagnosis.

When this is made, if there are serious troubles and interference is necessary, several processes present themselves: by *acupuncture*, several pricks are made on the foreign body; it is irritated, its disag-

gregation is attempted; success is very uncertain. *Needles firing* has given some results. The *fixation* of the arthrophyte to the capsula, or a part outside of the articular surfaces, has been recommended. The animal kept standing, with the fingers the foreign body is brought to the selected part and fixed, with a very fine steel peg. The region is then immobilized. After five or six days, the adhesion is perfect, the steel peg is removed. The articular inflammation resulting from this manipulation is treated by cold. This method has but few advocates; it is difficult to find a "convenient spot" to fix the arthrophyte.

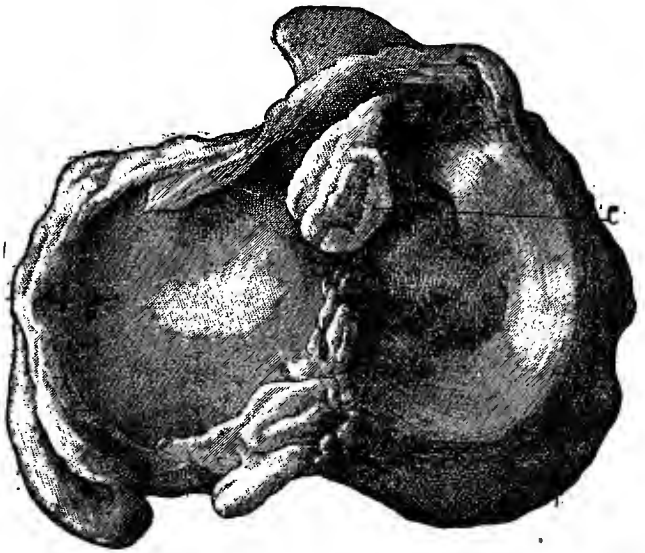


Fig 118.—Dry arthritis of the stifle joint. Articular surface of the tibia. c, foreign osteo-cartilaginous body attached to the synovial by a peduncle. (From a photograph.)

Extraction remains the select operation. But it is delicate in animals; to safely hold the foreign body during the incision, anesthesia is necessary, and the opening of the articulation exposes it to suppurative arthritis: it demands a severe asepsy. Here is the modus operandi. After careful disinfection of the joint, the foreign substance is held fixed with the left hand or the fingers of an assistant. Over it, the operator incises all the peri-articular tissues in avoiding large vessels and nerves. The synovial must not be open until hemostasis is made on the edges of the wound, so as to avoid the introduction of blood into the joint. The arthrophyte may enucleate under the pressure of the fingers or be extracted by forceps. The edges of the wound are closed

by stitches, and the whole covered with iodoform or iodoformed collodion, with a wadded dressing, insuring the immobilization of the joint.

Let us add that, in general, as these products exist in articulations already much altered, interference is followed only by poor results or perhaps none at all.

XII.

ANKYLOSIS.

In those morbid conditions, always secondary, joints have lost the whole or part of their normal movements. Between the simple articular fissure and the complete union of bony extremities, there are numerous intermediates. In every ankylosed joint, the various tissues co-operate for a certain portion, to immobilization; bones, synovials, ligaments, aproneuosis, muscles and the skin itself. Even nerves and blood-vessels are retracted.

Pathological anatomy has recognized: 1, *true or complete ankylosis*, in which the articular surfaces and the ligaments are interested; 2, *false* or *incomplete*, due to alterations of the peri-articular tissues.

Clinic has not accepted this division; it has been observed that lesions of the articular surfaces and ligaments permit sometimes extensive movements, while peri-articular alterations can immobilize a joint completely. For this reason, to-day, *true* or *complete* ankyloses are those where no motion whatever is allowed; while *false* or *incomplete* are those which reduce more or less the extent of the normal movements.

In complete ankylosis, there is: 1, the *interstitial bony ankylosis* or *by fusion*, ordinarily following suppurative arthritis, sometimes dry arthritis (spavin), and characterized by the disparition of the articular cavity, the union of the bony extremities uncovered of their cartilages; 2, *peripheric ankylosis* or *by bony layers*, very frequent in animals, and produced by the ossification of the peri-articular tissues and specially the ligaments. The cartilages and the synovial generally remain intact.

In the incomplete ankylosis there is also a division into *intracapsular*, due to plastic products, organized in the interior of the cavity, and *extracapsular*, produced by the retraction, induration or calcification of the peri-articular structure.

Frequently these various lesions are found in one ankylosis.

The prophylaxis of ankyloses consists in the rational treatment of the different diseases which it follows (articular or epiphysar fractures, acute or chronic inflammation of joints, serious wounds round articulations). If for all those immobilization is the first condition of recovery, if kept too long it promotes retraction of tissues and predisposes to ankylosis.

Complete immobilization being difficult to realize in animals, ankylosis is less feared than in man; however, during convalescence of arthropathies, it is indicated to submit the region to massage, and utilize douches, baths and exercise.

With incomplete ankylosis, it is again to the same means that one must resort: massage, hydrotherapy, moderate exercise, or passive action made with the hands and frequently repeated.

In large animals, complete ankylosis is incurable. For those of the knee, elbow, shoulder, hock, stifle, nothing can be done. High and double neurotomy, that of the median or sciatic, may be tried for true or false phalangeal ankylosis.

With small species the curative therapeutics can go further. If massage, mobilization, exercise fail; if the ankylosis made in bad position interferes with locomotion, the means used in human surgery can be resorted to for animals. The sudden straightening is better than the progressive. Under anesthesia, the bones will be forced into good position by violent traction or by subcutaneous tenotomies. If there is complete bony ankylosis, it must be broken (arthroclasia). To create a false articulation by osteotomy or to resect the articular extremities are more complex means, to this day not used in veterinary surgery.

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